1) (A water-powered undershot stamping mill): "The picture of an instrument which works by the power of water. By pushing the wheel the tail (beater arms) is lifted and falls forcefully on a mortar which is filled with old canvas until it is well pounded and flattened.

Two men in the corner have tied the two ends of a piece of cloth around their waist. They have beaten canvas in this cloth and wash it well until it is white. They then put it on the stone so that it dries and then they collect it in a pot."

2) "The beater canvas in a bin."

3) "Canvas pulp."

4) "The well with the windlass at its head."

5) "The papermaker takes the soft mass of paper (pulp) which is dispersed in water . . . a net (mould) made of the twigs of the orange tree; . . . the paper turns out well."

6) "The screen is placed on the paper and put on stones to remove the water."

7) "The paper is placed between two boards and some stones are placed on them."

8) "With a bunch of horsehair in the hand they put the paper on the wall (to dry)."

9) "Paper hanging on a rope (literally a "branch") to dry."

10) "Paper is placed on a board and trimmed with a knife."

11) "Starch is put in this and blown on the paper."

12) "Paper is placed on a board and varnished."

A papermaker and his tools. From a Kashmiri manuscript illustrating traditional crafts and trades, c. 1830–1840 A.D. India Office Library and Records, London, Add. Or. 1899.

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The Materials, Techniques and Structures of Islamic Bookmaking

Gulnar Bosch & Guy Petherbridge

This work is primarily concerned with that major vehicle for the written word in Islam, the book in codex form, and in this chapter the materials, techniques and characteristic structures used in its production will be surveyed. The crafts of calligraphy, book illumination and painting are only briefly referred to, as others have considered them at length elsewhere.

At the time in the 7th. and 8th. centuries A.D. when the young religion and culture of Islam was penetrating the Middle East and consolidating its power, the codex form of book (which is the book form that predominates to the present day) had passed through some five centuries of technical and structural evolution. The result was a well-functioning combination of materials and mechanical forms, whose basic principles changed little from then on. The codex consists of rectangular sheets of papyrus, parchment or paper folded into gatherings which are sewn together and attached to protective covers, the individual leaves being written either before or after compilation. The form had developed particularly to carry the doctrines and commentaries of those religions flourishing in this region prior to the Islamic conquests, of which Christianity was the most dominant.

The materials and techniques used in making the codex book amongst the communities of those countries bordering the Eastern Mediterranean, of which we have a substantial body of surviving evidence in the bound Coptic codices preserved by the Egyptian soil and climate as well as in late Roman and Byzantine written sources, were adopted for the needs of Islam.

This bookmaking tradition, however, seems to have been first introduced to the Arabs in Arabia itself by Ethiopian craftsmen, whose bookbindings to this day relate closely to early Coptic examples, particularly in the sewing techniques. Ethiopia had long had cultural ties with Southern and Western Arabia and also controlled parts of these regions for periods of time, and the Aksumite kings, after their conversion in the first half of the 4th century A.D., became particularly solicitous of the developing Christian communities of the area, coming to their defence when threatened by rival Jewish and pre-Islamic religious factions, notably during the campaign of 525-532 A.D. The strength of those Christian cities such as Zafar, Nagran and Sana'a and the prestige of their churches must imply the presence of scribes and bookmaking craftsmen who would be working within the Middle Eastern technical traditions, and with whom the early Muslims must have been in contact.
Al-Jahiz, writing in the 9th century A.D., says that the Abyssinians/Ethiopians claimed the credit of introducing to the Arabs the codex book form, *mayaf*. Certainly the term is borrowed from the Ethiopic and the historical and cultural circumstances would make this possible. Islamic tradition attributes the first book of the Qur’an to be made after the Prophet Muhammad’s death to Sälim b. Ma’qil, who called the form *mayaf*. Other traditions state that parts of the Qur’an had been written on loose leaves during the lifetime of Muhammad and that these were protected by wooden boards. These were then copied in book form by Zayd ibn Thabit in the time of Abū Bakr.6

Textblock Materials

Papyrus

Papyrus, as the primary writing material of the Roman Empire and the Hellenistic Near and Middle East,7 naturally became the material on which the text of the early forms of codex were written. Large numbers of Arabic papyri have been found in Egypt, some dating from the late 7th and early 8th centuries A.D., but most are single sheet, or relatively short documents concerned with state administration and taxation or private or commercial correspondence. In this land of its production, papyrus continued to be extensively used for Arabic writings through the third century of Islam, although few early Arabic codices are known. One, in the Egyptian National Library in Cairo, the Jāmi‘ of Ibn Wāhbi, a collection of traditions written at Asnā in Egypt, is dated 276 A.H./889 A.D. Another, also of Egyptian origin, is the story of the prophets in the tradition of Wābih ibn Munābīh and is dated 230 A.H./844 A.D.8

Documents have survived referring to the production, the types, the trade, and the price of papyrus. Al-Jahiz says that Egyptian papyrus is for the West what the paper of Samarqand is for the East. However, most of these references are to papyrus in roll or scroll form, although Irgon7 suggests that, from the time of the late Roman Empire, sheets may have been made especially to the formats needed for codex production. By the middle of the 10th century A.D., production is in sharp decline as is the quality of the product. The century of the industry then shifted for a period to Sicily.9 Probably papyrus could no longer compete with paper which had taken over as the Islamic writing material *par excellence*. This cessation of production contributed to the introduction of Islamic paper into the Byzantine scriptoria. The conservative Imperial Chancellery, as the heirs of Roman bureaucracy, traditionally used papyrus rolls for important documents such as chrysobulls and were forced to adopt paper, as the material most resembling papyrus, in the middle of the 11th century A.D. (rather than use parchment, which by then had become the usual material on which codex books were written in the Byzantine Empire).10

In Islamic manuscripts, as well as being used for the body of the text, papyrus sheets were decorated for use as endpapers,11 if the evidence of surviving fragments has been interpreted correctly. From the early years of codex manufacture in the Middle East, papyrus sheets, often as waste scribal trials or leaves from discarded Christian or Islamic manuscripts, were pasted together and left under pressure to dry, forming thin boards which were then used as the basis of bookcovers. The latest recorded use of papyrus pasteboards seems to be in an 11th century bookcover of horizontal format in the Egyptian National Library, Cairo.12 Such boards were the precursors of the paper pasteboards so characteristic of later Islamic bookbindings.

Parchment

Codices with leaves of parchment, a material better suited to the mechanical requirements of the codex form than papyrus, had a considerable previous history in the regions which became the heartlands of Islam. A small number of such codices survive from the first four centuries of Islam, notably in the national collections of Tunis and Cairo.

Although the books of the Christian and other cultures conquered by Islam were characterized of the vertical format we are familiar with today, in which the height of the folios and covers is greater than their width, and which was the first adopted for the Islamic codex,14 by the 2nd century A.H./8th century A.D. Islamic books were changing from the vertical to the horizontal format.15 This change may have been in response to the characteristics of the Kūfī script itself or, as Eßlinger- hausen has suggested,16 in imitation of epigraphical Qur’ānic panels in architecture. A reversion to the vertical format begins in the 4th century A.H./10th century A.D. and coincides with the development of the delicate and lighter Eastern Kūfī script and with the change from parchment to paper as the predominant writing material.17 The horizontal format is exclusively used in the Kairouan bindings of the 9th and 10th centuries A.D., and the majority of the 11th,18 and continued to be used in the Western areas of the Islamic world far longer than in the East, as did parchment as a writing material (until the 8th century A.H./14th century A.D.).

Nadin (c. 377/987–988), in the Fihrist, says that skins were prepared so that people could write on them;19 and he contrasts the Byzantines’ *κελάδα* or Rūmī, writing materials—the skin of the wild ass, *raqaq* دم / دم / دم / دم / دم / دم, or parchment and vellum with those of the Persians, which were buffalo hides, cow hides, and sheepskins. He sympathizes with the people of Baghdad, who were forced to write for two years in *fayjad turus* تورع تورع تورع تورع تورع , or on palm leaves, because the storehouses were plundered in the civil wars of the Abbāsid Caliph Amin (reigned 193/899–906), and he informs us that the skins were very dry when they prepared them with *marruq* موض , or depilate paste, the main ingredient of which is lime,20 but that the skins became soft when they used the Kūfī method of preparation with dates.21

Apart from this reference and a recipe in the *Plitho* of Giovanventura Rosetti, printed in 1548, which purports to be derived from the Islamic Near East but actually describes the process of alum tawing,22 no Islamic descriptions seem to have survived of the methods of the production of parchment. However, examination of surviving parchment book leaves indicates that the skins were prepared by methods similar to those documented in mediaeval Europe.23

Goat and sheep skins were the usual materials of the early Islamic parchments but skins of wild animals such as the gazelle were also used. The quality of some of these parchments, for example that of a Qur’an of vertical format in Western Kūfī script, copied and illuminated by ‘Alī ibn Ahmad al-Warrāq for the Ḥādīth (the narse) of the Ṣimā‘ al-Mu‘tāz ibn Bādis (the father of the author of the bookmaking manual) in 410 A.H./1020 A.D. and now in the National Institute of Archaeology and Art, Tunis,24 is exceptionally high, being very supple with a wonderful velvety white colour. As in luxury documents and manuscripts emanating from the Byzantine court, parchments were sometimes dyed a deep blue
and written in gold ink. Of particular beauty are the Qur’an which al-
Mu’tamin (813–817 A.D.) presented to the chief mosque of Meshed and an
almost complete Qur’an copied probably in the early 4th. century A.H./
10th. century A.D. in Cairo. 26

While cataloguing the Arabic manuscripts in the library of the Escorial in
Spain, a Spanish orientalist Miguel Casiri (1710–1791) came across an
account, in an Arabic text dated 1482 A.D. based on the writings of
various early authors, which he published in his Bibliotheca Arabico-
Hispana Escorialensis (Madrid, 1760–70).

In the city of Samarqand a very fine paper is used, that is found nowhere else
except amongst the Chinese. The Arabs, after their conquest of that city in 704
A.D., introduced amongst themselves the methods of its manufacture. 27

While this date of the siege and capture may not be correct (it may have
been 712 A.D.) and according to other Islamic historians, including the
author of The Kingdoms and their Routes, papermaking was not intro-
duced to Samarqand until after the battle of Thulais (751 A.D.) when Arab
forces captured Chinese with papermaking knowledge, the place and the
general time period have become conventionally accepted for the intro-
duction of this manufacture into the Islamic world. 28

Paper was known, however, in other areas of the Arab world prior to
this time. Its first mention by Arab writers is in 30 A.H./650 A.D. The
first in Islam to use paper was reputedly the Caliph Omar in Mecca. 29

An important trade in paper is also indicated by the mention of a paper market
in Baghdad in 830–832 A.D. 30 Samarqand seems to have enjoyed either a
monopoly or an overwhelming predominance in papermaking for some time,
although its manufacture did spread to Khorasan. These papers, as well as fine
quality Chinese papers, maintained a high reputation for many centuries.

The renowned 10th./11th. century A.D. calligrapher, Ibn al-Bawwab,
master of the Nashki script, setting out to restore the missing section of
a manuscript in the hand of Ibn Mugliah writes,

I went to the library and searched among the old papers for a paper resembling
that of the Qur’an. There were several sorts of old Samarqand and China paper
in the library; very fine and admirable papers. I took what suited me and wrote
out the missing juz.

Part of his reward for this work was cut sheets of Chinese paper. 31 The
Safavid treatise on calligraphers and painters by Qadhi Ahmad, written c.
1015 A.H./1606 A.D., quotes a poem by the calligrapher Maulanā Sultan-
‘Ali: 32

On Paper
There is no paper better than Chinese 0kh[t?]a
However much you may try,
Saffron, henna, and a few drops
Of ink are (the means of the test). 33
Until then, do not approve.
How good is the Samarqand paper!
Do not reject it if you are wise.
Writing upon it comes out clearly and well,
But the paper should be clean and white.

The new writing material soon gained prestige and popularity and quite
rapidly became preferred to papyrus and parchment, as indicated by the
report that the Tahirid governor of Baghdad, finding himself short of paper
during the wars of Mustan’ and Mu’tazz (248–255 A.H./862–869 A.D.),
instigated his secretary to write in a small hand and to be brief, since
papyrus was not desirable. 34 Apart from the early 9th. century A.D. men-
tion of the paper market in Baghdad, the use of paper in that city is
indicated between the years 754 and 775 A.D. and was being manufactured
there by 794–795 A.D. At the end of the 8th. century A.D. Harun al-
Raschid and his Barmakid viziers, the brothers Fadl and Ja’far, promoted
the industry and paper was used in the state chancellery. 35 That it had
already gained considerable status is indicated by recommendations to
the public to use it even for the copying of the Qur’an. 36

In the 9th. century A.D. paper-mills were established in other centres:
Tihama and San’a in the south-west of the Arabian peninsula and at Cairo.

By the end of the 10th. century Egypt was well-known for its paper. 37 A
Persian traveller, Nasir-i-Khusraw, in the first half of the 11th. century
A.D. was amazed to find the merchants of Cairo wrapping their goods in
paper. 38 There was even a street whose name indicates that it was a
location for dealing in old papers. Papermaking is reported in Tripoli,
Hama and Damascus in Syria. This latter city became an important place
of exportation of paper to Europe and gave its name to oriental papers
in use there.

Papermaking spread along the North African littoral and by the second half
of the 10th. century A.D. was found in Tunisia, trailer, Creta and Fez. 39

As well as the reference in written sources to papermaking in the second
and third centuries Hegira, a number of early papers have survived. The
oldest paper from a codex to which a date can reasonably be attributed
is a bifolio of the Alf Laylah or Thousand Nights. This sheet, now in the
Oriental Institute, Chicago, (OF 17618; Catalogue no. 98) was later used as
waste paper by a professional legal witness to try out a number of times with
his pen the formula phrases used to witness legal documents. He gives his
name, place and date (266 A.H.). As a reasonable time must
have elapsed for the original codex to become discarded as waste, this
paper is considered to predate that of the copy of the Gharir al-Hadith,
dated 252 A.H./866 A.D., in Leiden. The only other dated paper codex
of the first century A.H. is a copy of the Maximil of Ibn Hajar copied
in 266 A.H./879 A.D. and now in the Zahririyah Library, Damascus. 40

By the 10th. century A.D., the Muslims in Spain were using paper for
accounts and Correspondence but it is not until 1056 A.D. that we have
the first secure evidence for a paper-mill. In that year it is recorded that
Abu Masafa or Abu-Musafaf owned a paper-mill near Xativa where 20
workmen were employed. His son Mutamin established another paper-
mill at Ruzafa in 1094 A.D. while another has been mentioned in Toledo
in 1085 A.D. 41

Xativa remained Islamic territory until 1238 A.D. Its paper acquired
great renown. Al-Iдрrfi, the geographer, wrote c. 1150 A.D. that magnifi-
cent paper is made such as can be found in no other place, and is exported
to East and West. Ibn al-Wardi stated that in Xativa on excellent and
incomparable paper is manufactured, an opinion supported by another
medieval writer, Qasim al-Sinbaj in his Chronicle of the Moorish Kings
of Cordobo, that the finest and whitest paper in the world is made at Xativa. 42

After the Christian reconquest of Valencia in 1238 and Xativa in 1248 the
Moslem and Jewish papermakers continued their craft, still producing
the classic Arabic paper until well into the second half of the 14th. century
although substantial taxes were imposed. The earliest surviving example of this paper is in the Mozarabic Breviary and Missal of the Library of Sancho de Silos and possibly dates to the second half of the 10th century A.D.  

The eleventh chapter of the Staff of the Scribes and Implements of the Discerning, the 11th century A.D. treatise by Ibn Badiis, begins with a description of the manufacture of paper:  

The first whitening is purified from its reed. It is moistened and combed until it softens. Then it is soaked in quicklime a night until morning. It is then rubbed with the hands and spread out in the sun until all of it dries in the daylight. It is then returned to water of quicklime, not the first water. It is so the next night until morning. It is then rubbed as in the first rubbing and spread out in the sun. This is done so three or five or seven days. If the water of quicklime is changed twice a day, then it is better.  

If its whiteness is brought out, then cut it with the scissors little by little. It is then immersed in sweet water for seven days. The water is changed every day. When the quicklime has gone out from it, then it is pounded in a mortar very finely while it is moist. Then, nothing will be left of the lumps. Other water is put on it in a clean vessel. It is dissolved until it reaches a silky viscosity. Then it is introduced into the moulds in the desired size. These are made from the straw used for baskets, walis, and the walls are collapsable. Under it is an empty rib. The flax is beaten with the hand vigorously until it is mixed. Then it is thrown with the hand flat in the mould so that it will not be thick in one place and thin in another. When it is evened, then its water dries away. It is found proper in its mould. When the desired is attained, it is adjusted on a flat tablet. Then it is bound to a wall and straightened with the hand. It is left until it is dry. It separates and falls off.  

Linen and hemp are the traditional fibres of Islamic papermaking, the linen usually coming to the mill in the form of old rags and the hemp as ropes or cordage. Each fibre type might be used exclusively as a raw material or they might be mixed together. Raschid al-Din informs us that in the time of Harun al-Raschid the paper used was made from old ropes used in shipping. As for linen fibres, there are some indications, as in Ibn Badi’s description above, that the paper pulp was prepared from hair.  

After the fibres have undergone washing, alkali and other treatments to remove unwanted impurities and to reduce them to a workable state mechanically or by fermentation, they are beaten in order to produce the pulp or stock from which the paper is actually made. The description of Ibn Badi may refer to the most elementary beating apparatus, the pestle and mortar, which is still used in papermaking in some parts of East Asia. In the early centuries of Islam more efficient forms of beating machinery such as the human-operated trip hammer, as found until this century in India, China and Indo-China, and various forms of water powered wheels which operated beating hammers, must have been introduced. Such equipment derives from that used in the milling of foodstuffs of which we have descriptions by various mediaeval Islamic authors. A painting from a Kashmiri manuscript in the India Office Library and Records, written c. 1850–1860 A.D., illustrating traditional crafts and trades and their tools, shows the basic equipment of the Kashmiri Islamic papermaker including a water-powered undershot stamping mill. (Colour Plate A)  

The papermaker is shown sitting at the vat, as is still done today in India, holding the papermaking mould. This is placed in the suspension of pulp in water which the vat contains and withdrawn horizontally, leaving an even deposit of paper fibres on the screen of the mould, through which the water drains back into the vat. The type of mould depicted here has a long history in oriental papermaking and probably reflects little change from the Chinese moulds used in the period when papermaking was introduced into the Islamic world. It consists of three main parts and may be the kind described by Ibn Badi: (1) the rectangular mould frame defined by three pieces of wood morticed at the corners, with a number of wooden crossbars or ribs; this structure supports (2) the mould cover, or papermaking screen, which is made of closely juxtaposed lengths of grass or reeds laced together by lines of stitching at intervals; during the paperforming operation the mould cover is held onto the supporting mould frame by (3) two deckle sticks which can be clearly seen in the Kashmiri painting. The parallel rows of grass or reeds (laidwires) and the horsehair lacings tying them together (chainwires) leave mouldmarks in the paper sheets (those of the former are termed laidlines and the latter chainlines) which are characteristic of the type of mould used and assist in its identification even though the moulds themselves have not survived.  

This type of oriental mould cover is flexible in one axis (parallel to the laid-wires) and can be rolled. When the mould is taken from the vat the mould cover is lifted off and the paper transferred to a flat surface by turning the mould cover upside down and rolling it back so that the sheet of newly-made, wet paper is left on the surface. The paper could then be placed still damp against a flat surface such as a wall (as in Ibn Badi) or board so that it would dry flat and evenly. Alternatively a stack (or post) of freshly-made sheets could be pressed to remove excess moisture, and hung on a line to dry, whatever the drying method, the sheets were finally stacked and placed between boards under a weight so that they would be as even as possible.

The chainlines of Islamic papers produced in the Near and Middle East have characteristic groupings in which two, three or four sets of chainlines are placed fairly close together, each set separated by a gap approximately three times larger than the distances separating the sets within each group. Some Indian Islamic papers also show groupings of double sets of chainlines. In Spain by the 12th century A.D. a new type of mould was being used, the precursor of that used in European papermaking, in which the mould cover or screen was permanently fixed to the mould frame and was made of metal wires (initially it seems of iron). These early Spanish fixed moulds lacked sufficient supporting struts or ribs so that the screen sagged with the weight and hydraulic pressure of water and pulp during paper forming, producing distorted mouldmarks at the centre of the sheet. Spanish moulds also sometimes had double laidwires leaving distinctive mouldmarks.

Laid moulds were not the only category used in Islamic papermaking. There are substantial numbers of Islamic papers which reveal no clearly differentiated laid- or chainlines and would appear to have been made on some sort of wove mould, of which we have no surviving examples, but whose mould cover may have resembled those of Japanese moulds today in which the laid screen is covered with a woven textile (in this case of lacquered silk to waterproof it).
There is as yet no evidence that figurative or epigraphical watermarks were used in traditional Islamic papermaking, the flexing action of the screen probably inhibiting the durable attachment of such a marking device (of which corner weights or the rigid wires of the mould in the European tradition). That Egyptian papers were stamped with identifying marks, however, is indicated by an historical note in al-Baḥṣā’s Kitāb al-maḥāsīn wa-l-maṣāwī attributing to ‘Abd al-Malik, who lived during the reign of the Caliph al-Mu’tadid brūliḥ, the change of the tīrāz system from Greek to Arabic.²⁸

Many Spanish papers of the Valencia, Catalonia regions of the 12th. to mid-14th. centuries A.D. have characteristic marks which, however, are not true watermarks.²⁷ In these a mark, in the form of an extended zigzag or series of overlapping diagonal crosses, has been drawn with a brush or a pointed implement while the newly-made paper was still moist. The significance of these marks is obscure but they may imitate the knife marks sometimes used by mediaeval parchment makers, and still used by Moroccan tanners today, to indicate the skins worked by individual craftsmen.²⁹ The oldest of the zigzag papers are contained in the codex of Sibawaih’s Grammatica written in Spain in 558 A.H./1160 A.D. (Bibliothèque Nationale MS. Arabic 6499). The paper sheets of this manuscript alternate with parchment ones, which are also marked with zigzags.³⁰ Papers marked in this fashion are found used in Fez, Tunis, Tlemcen and Ceuta and indicate the close trade connections between Valencia/Catalonia and the Maghrib.³¹

The size of the papermaking mould, of course, dictates the size of the sheet of paper produced. Islamic authors give us a number of indications of the range of types used in certain regions and their sizes. There seems to have been a preference in luxury items for a large format heavy paper, a preference which was prompted at times by ulterior motives. Ibn Abi Uṣayfī (1203–1270 A.D.) saw a book of the 9th. century in the writing of al-Azraqi, the son of Hujadin ibn Ishāq (the translator of numerous Greek works into Syriac and Arabic). The book was extremely heavy due to its thick and large sheets of paper, each weighing the equivalent of three or four ordinary sheets and measuring one-third of a Baghādādi in size. Their works literally commanded their weight in silver dirhams and so they had especially commissioned the heavier paper to increase the weight of the book. The text was written in large Kufic letters, with lines far apart to stretch the work out yet more.³²

Al-Jauhari,³³ at the end of the 10th. and the beginning of the 11th. century A.D., describes the best paper of his time as pure white, full-size, smooth, symmetrical of edges, and of a quality that will last a long time. As to the varieties of paper seen in his time, he describes the Baghādādi as a heavy paper yet pliable, smooth-surfaces and symmetrical. This large paper was not used full-sized as a rule except for Qur’ān verses and perhaps by the secretaries of the chancery for treaties and the decrees of the Sultanate. Next to the Baghādādi in classification, he places two varieties of the Shiʿa, or Syrian paper. One known as the Ḥumawī was inferior in cut to the Baghādādi while the other variety was inferior in strength. Next in order is the Miṣrī, or Egyptian, type of paper and it is inferior to both of the Shiʿa varieties. The Miṣrī also has two varieties, the Manṣūrī and the ordinary kind. The Manṣūrī is the larger and its surface is entirely burnished while those of the ordinary kind are not. Other papers than these are classified according to their length and breadth.

Among these is described a variety known as the Fawwāḥ,³⁴ small of size, rough, and not used in writing but for wrapping sweets and drugs. In listing the brands and sizes of papers, Quhasherītī tells us that measurements in the old days depended on the popular words: مُسْقُرَة, or scroll, which they divided according to the rank or profession of the user into two-thirds, halves, thirds, fourths, and sixths, and that in his time the tāmār was replaced by the farkīh, مَظْعِزَة, or sheet, کُنَوْل, or full-size, with the proportions of the Baghādādi as the standard.³⁵

He gives nine types in use: beginning with: (1) the standard, the full-size Baghādādi one cubit (the linen cubit of Egypt) in width, by one-and-one-half cubits in length (1099mm × 733mm); (2) the diminished Baghādādi (977mm × 651mm), of the Miṣrī or Egyptian type paper; (3) the two-thirds of the full-size Manṣūrī (688mm × 325mm); (4) the half-Manṣūrī (666mm × 244mm); (5) the one-third Manṣūrī (344mm × 162mm); (6) the familiar (so-called) Manṣūrī, really one-fourth Manṣūrī (213mm × 142mm); (7) the ordinary paper (183mm × 122mm); and of the Shami or Syrian-type paper; (8) the full-size Shami; and (9) the smallest size called warāq al-taʿīr, or bird-paper (91mm × 61mm), which was extremely thin and used for writing dispatches to be sent by pigeon post.³⁶

Irganī has carried out an investigation of Islamic papers, probably of Syrian origin, utilised in Byzantine manuscripts from the middle of the 11th. century A.D. These were found to conform to the three principle formats, averaging after trimming during bookbinding: 380mm × 280mm; 520mm × 380mm; and 760mm × 520mm. Measurement of Byzantine archival documents, whose edges have been less trimmed than those of codices, indicates that the original dimensions of the intermediate size are approximately 580mm × 420mm and he suggests for the smaller and larger formats original sizes of 420mm × 290mm and 840mm × 580mm respectively, none of which conforms to the theoretical reconstructions of sizes by Kurasbecue.

These formats are interrelated so that the width of one format is equal to the height of the format immediately smaller than it and is half the height of the format immediately larger. This system enables the simultaneous use of different formats by appropriate folding of the sheets.

It would appear from the above that there was indeed a degree of standardisation of terminology and format in the papers produced in the Near and Middle East. However, the situation seems to be very different in the papers of the only other area of the Islamic papermaking tradition of which we have detailed information. As Oriol Valls i Subirà states, Another highly complex aspect of the history of Catalan papers is that of paper sizes. Anarchy has always reigned in this department... Every papermaker made, and always has made, his paper in accordance with his own—or his customer's wishes, and the most anarchic craft in all Spain must surely have been that of paper manufacture. Nor did the papermakers ever combine into fraternities, guilds, or societies.³⁷

Foolscap was the format of paper exclusively used in Catalan archives, but even within this single format more than thirty sizes have been recorded. The most commonly encountered are: 460/470mm × 280/290mm; 430/450mm × 250/270mm; 400/415mm × 290/300mm; and 440mm × 305mm, from which measurements it seems that an average vertical measurement of 290mm for the leaf after a single folding was the aim.³⁸ The smallest sheet recorded (360mm × 270mm) is dated 1238 A.D. and the largest (500mm × 320mm) is dated 1320 A.D.³⁹
These sizes are reported to be typical for Catalonia but bear no relation to those recorded for the Near East nor to the Italian paper sizes listed by Briquet. Another twist to the problem of standard sizes was caused by the "Saracen papermakers of Xativa" in the first half of the 14th century A.D., by then under Christian domination, who were chastised by King Alfonso IV in 1311 A.D. and King Peter IV in 1338 A.D. and 1341 A.D. for fraudulently reducing the size of the sheet and threatening them with punishment, seemingly to no avail.3

A text written at the end of the 16th century A.D., the Manṣūḥ-i Hīnervārān, by Muṣṭafā 'Alī lists the papers used during this later period, (1) Daulatābādī (from Daulatorābād, India); (2) Khāṭa'ī (from Kathay or North China); (3) 'Adiṣhāḥī (from Adisha); (4) Hāriri (paper from Samārqand); (5) Sulānī (from Samārqand); (6) Hindī (Indian); (7) Nizāmshāhī (from Nizamshah); (8) Qasīmbeqī (from Qasim Beg); (9) Hāriri (an Indian paper which cracked in course of time); (10) Guni (from Tabriz, the colour of moist sugar—the making of this paper was a speciality of this city). He adds that,

The most ordinary paper is produced at the mills at Damascus, the value of which is slight and well known. Nūs, "The hubashī (Abbyssinian) and dīmsīshī (Damasccus) papers are worthless; no paper should be employed that is inferior in quality to that of Samārqand."

As mentioned above, there was a flourishing trade exporting Islamic papers to the Byzantine Empire and other areas of Christian Europe from the 11th century A.D. onwards and it was from Islam that the techniques of papermaking were ultimately transmitted. However, by the 14th century A.D., as the new European industry established itself, the direction of the papermaking trade began to reverse. By the 15th century A.D., Italy was the main source of paper for Greek manuscripts.3 Already by the mid-14th century A.D. the Arab chancelleries of North Africa were using some European papers3 and the famous papermaking centres of Egypt and Syria were beginning to feel the effects of the competition, though it was centuries before papermaking really diminished in the central Islamic world.

Yalāl ibn Subḥar records an Islamic document, dated 1360 A.D., whose paper appears to be Italian, possibly from Fabriano, but possesses a watermark and a zigzag, the latter marking being most unusual in Islamic papers and must have been specially included for the Maghribi or Catalan market.3 European paper was much used in books produced in the Ot- tomans court in the second half of the 15th century A.D. and it is recorded that the Anatolian Turcoman Emir Dhu'l-Qadr Qurban Shamsul-War El- bistan in the year 873 A.H./1468 A.D. composed a letter scritta su carta franca, cosparsa di polvere d’oro, con scritto sopra lana.3 The European papermakers, although by now using the advanced rigid mould and sizing with gelatine instead of starch, were concerned that they provide their various Islamic markets with the type of product to which they were accustomed. Venice supplied papers to Turkey which derived from the North Italian papermaking hinterland, from centres such as Sālō sul Garda, Bergamo, Vicenza, Padova, Friuli (and also for a time from Fabriano) many of which were provided with watermarks with significance for the Ottomans and their other Muslim customers.3 Popular elements were the crescent, the star, and a crown. The three crescents watermark (known in Venice as Trelane) was especially common in export papers of the 17th and 18th centuries A.D.; these often have Venetian coun-

termarks.36 During this period Italian papers are even found in Qur'āns produced on the East African coast.37 Venice also exported papers to Syria, Egypt and North Africa.

France also from the 15th century A.D. onwards exported papers to the Islamic world. Her papermakers also saw that papers were watermarked to suit the tastes of their clients. Syria appears to have been a particularly important customer, imports being mentioned in 1775 A.D.38 That the French as well as the Italians were exporting paper to Istanbul in the first half of the 18th century A.D. is indicated by their use in the first Turkish printed books from the workshop of Ibrahim Mutaferrika.

Although papermaking is recorded in Tabriz in Western Persia in the 13th century A.D. and it is recorded that paper was traded in Armenian Ani in Eastern Anatolia during the time of the Bagratids—so that it is possible that paper may have been manufactured in the older Islamised areas of Asia Minor—Ottoman Turkey does not seem to have had a paper mill until the mid-18th century A.D. This was established at Kâğıdîklâhne in Istanbul, in which area paper had been made in the late Byzantine period. The mill is reported by the French traveller Castellan to have been established by the Venetians; it is recorded as being in existence in the time of Mahmud I (1730-1754 A.D.). Other mills were set up, probably also with the assistance of foreign papermaking experts (the renegade Englishman Selim Aghe (c. 1805) is reported to have advised at the Khünkâar iskelesi mill), at Yalova (Yalq-âb) (1139 A.H./1746 A.D.), under Selim III (1789-1807 A.D.) at Istanbul and at Beykoz or Khünkâar iskelesi. These, however, did not have much success. Charles White, an Englishman who stayed for three years in Istanbul, noted in 1840 that these mills faced difficulty in the face of less costly imports of paper from Italy.39 France, Germany and England and Walsh, in 1838, noted the neglect of the industry after Selim.

It should be noted that by the 18th and 19th centuries A.D. some, at least, of the papers produced by local mills were destined for the printing industry which required different paper characteristics (low degree of sizing, compressibility, etc.) from those for traditional Islamic calligraphic techniques. But the manuscript tradition flourished far longer in the Islamic world than it did in the West and paradoxically, while the European paper industry had swamped that of its Islamic antecedents for centuries, this ability to fulfil the requirements of its customers may have helped the hand papermakers of regions like the Veneto to survive longer than they might otherwise into the era of machine papermaking. For instance, as late as 1870 three-quarters of the hand-made paper production of the province of Treviso was exported to the Levant via Venice and Trieste.40

Islamic calligraphers and the users of their works showed a particular love for coloured papers and many beautiful examples have survived. As in the Qur'ān, Oriental Institute A12029D (Colour Plate E), a book might be made up of gatherings dyed different colours. Such appreciation is well expressed by Sultan 'Ali:

The colour of paper best for writing. There is no better colour than that of Chinese (khitān) paper. There is no need for you to test: Writing on it is good, it is also good for gold. It is excellent and it embellishes good writing.
Paper Sizing and Burnishing

It was customary for Islamic writing papers to be given a highly burnished surface. European traditional hand-made papers were gelatine sized, but Islamic papers, after they were formed and dried flat, were sized with a vegetable starch or gum in order that a suitable non-absorbent surface could be made by burnishing. The paper could either be tub-sized or the size could be spread over the sheet in paste or powder form. Either process helped to fill the pores of the paper and, with the burnishing, made it appear whiter. As early documents reveal, paper initially imitated the appearance of parchment, but there was also a practical aspect to the sizing and burnishing—inks which had been developed for use on parchment surfaces and for which pen types and calligraphic styles had evolved required the compact, smooth surface of the parchment skin as prepared for writing. In the transitional period before paper became the dominant writing material, scribes and calligraphers would have to use both materials (as well as papyrus in the Near East) in the course of their work. Individual codices were sometimes made up of both paper and parchment gatherings, as in the case of the 12th-century A.D. codex of Sibawaih’s Gramatica mentioned above, and quite frequently in 12th- to 14th-century A.D. Byzantine manuscripts.

A number of Islamic descriptions describe the techniques and materials involved in creating the polished surface. Qalî Aḥmad quotes a poem by Maulâna Sultân-Allâh:

On whit paste
Prepare the whit paste 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 (Qa'ab-‘asirih)
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 whit to your paper,
Moisten the paper slightly with water, carefully.

Ibn Bâdis after describing papermaking gives a group of recipes for preparing paper for burning:

One may take a powder, shining white, pure chalk and starch in equal quantities. The powder and the starch are macerated in cold water until there is no lumpiness. It is heated to the boiling point. When it boils, it is filtered on that powder. It is stirred until it sets and it becomes a sheet. Then the sheet is dried back and glazed with the hand, then put on a reed. When all the sheet is glazed, the sheet is dry. It is glazed from the other side, then returned to a flat table. Water is sprinkled on it lightly. It is then gathered and stacked. It is polished as one with a cloth. Write on it.

Description of soaking of the paper. A very white kind of rice is cooked vigorously in a pot or in a glazed pan. There is no fat in the pot. It is washed, then the water of the rice is filtered in a sieve or it is drawn through a clean cloth. It is then spread out on a clean cloth. It is so until it is dry. Some people cook the husks and take the water with which it was soaked. Some people wet the whole or soak it with starch. This is after it is boiled with water and soaked as described. Description of beautifying the paper that has been tested. In a copper pot, ten talls of sweet water and good clean starch are cooked on the fire. It is boiled more than once until the water is diminished by two fingers or more. Then there

special favours were bestowed. Red also symbolized humanity and was thus used when presenting petitions for justice.49
is added a little sufiyon in a quantity to strengthen its colour or purity. The solution is poured into a wide basin. The sheet is immersed in it lightly with care so that it is not torn. It is spread with a thin flax string in the shade. One must be careful that it is not reached by the sun else it will be spoiled. It is examined every hour with a burning over so that it will not stick. When dry, it is polished with glass burnishers on a board.

Another description of it. Old straw is moistened in water for three days. It is then boiled until a third of the water is lost. Starch, in the mentioned weight of the first description, is thrown into it. It comes out improved for pen colouring and drawing.

In many Islamic manuscript paintings which include a scribe or scribes at work in the composition, a figure is shown kneeling down and burnishing a sheet of paper on a wooden board, an action described by Sultan Ali. 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 soft.

The burnishing implement appears to vary from region to region. Moghul depictions of bookmaking craftsmen in the beautifully painted margins of two pages of the Jahangir Album (one in the Freer Gallery of Art, Washington) (Fig. 1) and the other in the Prussian State Library, West Berlin) of approximately the same period as the poems by Sultan Ali, include paper burnishing done with a pestle-like tool with broad rounded base on a wooden board. This type, often with a very stubby handle, is the most commonly observed in Islamic manuscript paintings but other tools were also used. In Turkey large oval glass bulbs were used, a group of which is preserved in the Topkapi Saray Museum, Istanbul (Fig. 2). In Istanbul to the present day paper marblers and calligraphers also use another type consisting of a bar of wood which holds a rectangular piece of hard polished stone (such as agate) with rounded edges. Burning tools were mentioned by the traveller Olefarsi, They make their paper of old rags, as we do, which for the most part are of Cotton and Silk, and that it may not be hairy or uneven, they make it smooth with a Polishing-stone, or sometimes with an Oyster or mussel-shell.

This sizing and burnishing was carried out either by the papermaker or paper dealer and very frequently by the scribe or calligrapher himself. The 17th century A.D. traveller Evliya Celebi mentions the paper merchants of Istanbul whom, after their shops with Persian and Venetian paper, they pass (the time) smoothing and glazing paper in their shops. As part of the successful export trade of papers to the Anatolia and the Levant, Venice supplied paper which was already burnished. Notwithstanding, the Turks themselves acquired a great reputation for the burnishing of paper and elsewhere in the Levant it is recorded that imported European paper was reburnished before use.

Decorated papers became popular from the 16th century A.D. onwards for the margins or leaves of books, particularly for calligraphy or painting albums. These might be individually painted or speckled with gold, silver and other colours or marbled. Such sprinkled or marbled papers became used for endleaves, pastedowns and double leaves especially in Ottoman and Persian productions. Marbled papers were also used to cover the outside of bookbindings.

Marbled papers are known from Persian manuscripts of the early 16th century A.D., and had been introduced into Europe by the end of that century. Turkey became famous for this art where it survives to the present day in its traditional forms. Sir Francis Bacon wrote of the process in his Sylva Sylvarum, London 1629.

"The Turks have a pretty art of camoufetting of paper which is not with us in use. They take divers dyed colors and put them severally in drops upon the water and stir the water lightly and then wet their paper (being of some thickness) with it and the paper will be wavier and valued like champlevé or marble."

Paper was even sent from Europe to Istanbul to be marbled.

Skills in the gold sprinkling and marbling of paper were much praised. Qadi Ahmad wrote of Maulana Yahhya, a native of Qazvin, in the restoration of books, tinting of paper, and in art (marbling) he is very . . . with regard to the art he has good achievements . . . and of Abu-Ma'mim Mirza, He has good taste in portraiture and artistic design. He spends all his time on art and work: not for a moment does he slacken in this. He is incomparable in painting, carving, restoration of books, gold sprinkling, bookbinding, making pasteboard, engraving seals, carving tables and spoons, dissolving tapiazials, and other small artistry. He spent a long time with beardless youths until his hair turned gray . . . ."

Formation of Gatherings

It is usual, when producing books of codex format, for the sheet or skin of writing material to be larger than the final leaf size. The sheets are
folded in half on their long side, each successive fold being at right angles to the one preceding it. This folding is done one, two, three or four times thus producing two, four, eight or sixteen leaves respectively. Some of the resulting folds in the smaller formats would be at the edges but these would ultimately be trimmed so that the leaves of the book could be opened. By this system of folding and trimming groups of bifolios were produced whose spine folds were inserted into one another. Each grouping of these bifolios is called a gathering, or quire, and can be sewn as a single unit. The gatherings which constitute a volume are sewn together to produce the codex form. The number of leaves in a gathering would usually be 2, 4, 8, 16 caused by the simple folding of the sheets or individual sheets might be added giving 10 or 12 leaves etc. Odd numbers might also occasionally be produced by the tipping on of an extra sheet. Sheets folded in four or eight might also be wrapped around one another to give gatherings of 8, 12 or 16 leaves.

Fig. 3. Diagram giving the terminology for the constituent parts of Islamic books in codex form.

COLOUR PLATE C
The preparation of a red dye. A marginal painting from a leaf of an album made for Jahangir (ruled from 1605–1627 A.D.) Staatbibliothek Preussischer Kulturbesitz, West Berlin, Abb. 5.83.

COLOUR PLATE D
A craftsman dying a sheet of paper red. A marginal painting, adjacent to that shown in Fig. 3, from a leaf of an album made for Jahangir. Staatbibliothek Preussischer Kulturbesitz, West Berlin, Abb. 5.83.

COLOUR PLATE E
Untied and dyed paper gatherings from a Qur'an (folios 225mm x 155mm), Mamluk, 15th century A.D. Oriental Institute AR2020.
In the case of manuscripts of very large format, as well as in the case of smaller formats when only small sheets were available, which when folded would produce too small a leaf, each leaf may be made up of a full sheet of paper and these made up into bifolios by pasting them together with a strip of paper (or guard) along the spine edge. In the case of parchment manuscripts care might be taken to ensure that in each opening both pages showed either the hair or flesh side of the skin. In codicological studies of Latin, Greek and Hebrew manuscripts, and in bibliographical studies of early printed books, substantial progress has been made in studying these characteristics and in relating them to specific chronologies but much pioneering work still needs to be done in the field of the material and structural analysis of Islamic manuscripts.

Ruling

After the gatherings are formed, indented blind lines could be ruled on the leaves to guide the even spacing of the lines of written text and margins and to create a unity of layout throughout a book. The study of ruling patterns, the implements used both to site the lines (pricking) and to rule, and the sequence in which the ruling was carried out (whether each leaf was ruled separately, whether the ruling was done on the folded gathering, from which side the ruling was done, etc.), may enable their attribution to specific areas or workshops as is being done for Western manuscripts. Whereas in the European and Greek traditions it was usual for points marking the basic layout to be pricked or stabbed in the leaves with a sharp implement and then for the ruling lines to be drawn between these prickings, in Islamic paper manuscripts (and in later Armenian ones) a ruling frame was often used, thus simplifying and speeding up the process. The leaves could be simply pressed over this frame whose wires or strings would leave their impression as guidelines. Qalqashandi mentions a ruling tool miṣṭarrah.

Calligraphy and Inks

As stated at the beginning of this chapter, we will not discuss here the writing, illumination and painting of the Islamic codex textblock. Because of the particular religious significance of writing and the written word in Islam, there exist extensive indigenous commentaries and documentation of calligraphers, and their works as well as their materials, tools and techniques. Ibn Aldis devotes a large section of his treatise to the manufacture of black and coloured inks.

Bookbinding

Bookbinding Tools

The bab fiṣāf at al-tijād, or chapter on the craft of bookbinding by Ibn Aldis, opens with a list of tools necessary in bookbinding. With these as a basis we shall compare the tools mentioned in other sources, especially those of Sufyani and Qalqashandi. It is a measure of the conservative nature of the Islamic bookbinding craft that most of the tools mentioned by these earlier authors can be seen in the later depictions of paintings in the Jahāṅgīr Album marginia (Figs. 5 & 8), the 19th century Kashmiri manuscript on crafts (India Office Library Add. Or. 1700 (Colour Plate B) and the 17th/18th century watercolour of a North Indian bookbinder (India Office Library and Records Add. Or. 1111) (Colour Plate F). We have arranged the tools according to their uses. Those for general purposes are:
(1) The bālīṭah or slab: As Islamic bookmaking craftsmen usually did not work at tables, this constitutes the most important working surface. Ibn Bāḍis says it should be of good quality black, white, or other colored marble, unmarred of surface, and the width of a single ruler's length in order to be used for the paring and binding processes. Sufyānī designates this slab as laḥb al-rūkhāmī or board of marble. In 20th century Iran the marble slab is called sang-e marmar.49

(2) The two kinds of presses are, according to Ibn Bāḍis: the miṣṭarār or press tightened by a rope used by the people of Iraq, Egypt, and Khorasan; and the miṣṭarāt al-maghāzī, or screw-press, used also by the people of Iraq and called “Salumān’s joiner” by the bookbinders and carpenters and “kaḥliḥīn” or “kaḥliñān” by the Byzantines. This type of press continued to be used in the Islamic world (Colour Plates B & F, Fig. 8) and is used even today in the European tradition. Ibn Bāḍis states, “The length of the rope-press should be proportionate to the section of the book to be fastened in it. If it were half-Maṣṣūṭ’s size the press should be longer. The rope press should have fully thick, perfectly true boards so that when they are closed they would hold even a piece of paper firmly. The rope should be twisted of new black hair, finer than flax, and it should be sufficiently long to go four times around the press from every side. The stick necessary in tightening the rope should be about the length of a finger, thin, smooth, and tapered. The boards of the press should be grooved or bevelled where the rope goes around the edges so the sword may be used along the press and not cut into the rope.” In his first listing of tools Ibn Bāḍis follows the miṣṭarār with the miṣṭarāt al-maghāzī, or presses, vices, but he omits them in his later description of the tools. Jauhari (d. c. 393/1002) describes the miṣṭamah, as consisting of two pieces of wood firmly held with iron. Qalqashandi describes the book being bound while the blockbook is in the miṣṭamah and the spine projecting. Ibn Bāḍis employs takhhtū mīḥār, as a general name for press. He also mentions, as does Ibn Bāḍis, the use of simple wooden pressing boards which would be left under a weight.

(3) The misūn, or whetstone, according to Ibn Bāḍis, should be level, perfect of surface, neither too soft so that the iron might dig into it, nor too hard so that the sharp iron is blunted by its hardness. He says that the craftsman customarily prepares his own whetstone by aligning, perfecting, and levelling it for his own requirements.50 It should be kept overnight in a grease pot to allow it to absorb the grease, which is the best thing for it. Qalqashandi in speaking of the misūn says, “It is of two kinds—dark grey known as the Rāmī, and green known as Hījāzī and Qaṣī. The Rāmī is the better of the two types; but the Hījāzī is the best of the green varieties.”

(4) The miṣṣās, or scissors should be well balanced and sharp in order to cut the leather and other materials, according to Ibn Bāḍis.

(5) The safī, or the sword, of Ibn Bāḍis’ tool list is twenty (probably “finger width”) is the measurement unit) or less in length, of medium width, and its blade should be well tempered. Its handle should fill the palm. This tool is clearly shown in the Kashmiri manuscript painting (Colour Plate B). Some craftsmen, he says, do not use the sword, because they cannot manipulate or work with it. They work instead with a long-bladed knife. This may be one of the tools surrounding the North Indian binder of the 17th/18th centuries (Colour Plate F). One of the marginalia in the Freer Jahangir Album leaf, however, shows a large file being used instead of a sword or knife (Fig. 8).

(6) The miṣṭarāt al-rūthīn, or folder, of this folder with which leather is worked, forcing out the air, stretching, evening, and straightening it. This folder should be very thick, its length a span, and its material of sīndyān servādī, or oakwood. It should be a piece of wood with thin edges in comparison to its breadth and length.51 So that when it passes over the leather it smoothes it, and its handle (miṣṭah) should be also of oakwood because ebony and boxwood dull their edges if they knock against the press. The miṣṭah, or handle of this folder is again mentioned in the process of preparing the quires for sewing, as an instrument which is passed over the center of the opened quires where the sewing of the thread will be done. Later it is used to hammer the sew page. The folder in bookbinding is used for many purposes and is shaped like a letter opener with a rounded rather than pointed end. Sufyānī uses qalābī, or folder, and describes it as useful in making the sections correspond with each other in aligning.52 These tools can be seen in both a marginal painting of a bookbinder working on a cover in the Freer Jahangir Album leaf (Fig. 5) and in the India Office Library painting of the North Indian binder (Colour Plate F).

Other tools used in the preparation and binding of the text block are:

(1) The kāzān, or mill, is used in pasting operations by Ibn Bāḍis; while miṣṭamah, is the usual term for a wooden mill which Sufyānī describes as heavy weighing four to six rajāl.53

(2) The ṣaba'ū, or awl, Ibn Bāḍis writes, should be very fine. Qalqashandi notes that “the mīfādhī, or awl, is made as a tool resembles the mīfādhī, or awl, and that it is used to pierce paper.” Sufyānī uses ṣafī, or awl, Ibn Bāḍis. Under ṣafī, or awl, Sufyānī explains that this means to sew with the help of an awl.54

(3) The ibrah, plural of ibrah, or needles, Ibn Bāḍis says, are of two varieties: those suitable for sewing the pages together and those that are used for the headband or habah.55 The first kind of needles should be thin, short, and perfect; the second should be shorter and heavier.56 Sufyānī adds the ṣafī, or long needle, like those used to make pack-saddles.

The tools used in the preparation and ornamentation (finishing) of the leather are:

(1) The ṣafī, or paring knife which Ibn Bāḍis says, should be of good iron, neither too hard nor too soft, and its weight should be in proportion to the size of the artisan’s hand. Sufyānī also uses this term for a “paring knife.” Such a knife is depicted in the Kashmiri manuscript (Colour Plate B). For the knife used by traditional binders today in Istanbul, see Fig. 4.

(2) The masāf, singular miṣṭarāt al-maṣāf, or rulers, treated by Ibn Bāḍis, are of varied woods: ebony, willow, boxwood, and oak. We have already discussed the miṣṭarāt al-rūthīn, or folder, under the tools used generally in bookbinding. Ibn Bāḍis states, The work ruler, miṣṭarāt al-maṣāf should be of safatī, or willowwood, because its edges might be scored; and if that should happen to the ebony ruler, it would leave nicks which would show as imperfections when lines are ruled.57

Fig. 4. A bookbinder’s paring knife, Istanbul. This illustration shows the bevelled edge of the blade.
He considers abnás, or ebony, and bugs, boxwood, the best for designing, inking, and coloring.
The ruler for designing should be long, firm-bodied, and neither thick nor thin; while that for inking should be very thin-bodied because it is manipulated by two fingers.
The colouring ruler (perhaps for rubrication) should also be thin-bodied and light in weight. A large ruler is depicted in the mid-19th-century Kashmiri manuscript painting of a bookbinder and his tools.
Qalqashandi only mentions a mīsārārah used to rule paper. Sufyānī says the mīsārārah is to cut against,136 which would not fit the definition given for “ruler” in Ricard’s index to the work which is like the mīsārārah of Qalqashandi, a ruling frame or mechanical device for ruling paper.137
The instrument, which Sufyānī mentions for ruling, tracing, and as an aid in designing, is the qurtābān, or square.
(3) The ḥikār, or compass, Ibn Badis feels, should be light, have two thin legs in order to make fine lines, and should be firmly riveted at the joint so that it opens and closes gradually.
Even if it is hard to open, it must be so for the compass is for the drawing of the “sans,” which are the tooled circles in the center of the book cover.138
Sufyānī calls the compass dāʿib, and uses it to make the design;43 but, he includes a second tool of this type—the tūbīnsh, or divider, used to make the circle of the central pattern of the cover.139
(4) The hadīd allahī lit-naṣagh, or, irons for ruling, may be divided into two groups: those of Ibn Badis which seem to be individual elements to be combined in many varied patterns; and those of Sufyānī which are panel stamps of composite patterns. The first group, hadīd allahī lit-naṣagh, includes (1) the bāzāc, or almond, (2) the qāwād called yādz al-bāz, or ornament, (4) the al-nuṣagh, or dot, and (5) the muṣawwara, or roundel. In the second group are the tūrūṣ, or single panel stamps cut with an entire design for the center of the cover, and one for the flap which should be one-fourth the size of that on the cover. Sufyānī uses the term tūrūṣ as a panel stamp for the center of the cover, rūk, or for a corner stamp, and navārā, for the panel stamp of the flap.140
(5) The mīqāṣḥ, plural manaqṣah, or burners, cutters, tweezers and points for decorating are mentioned as a group by Ibn Badis. Sufyāni specifically, among this group, the mīqāṣḥ, or engraving point, and both the hadīd qatū’ah, and the mīqāṣḥ, or sharp cutting points. For engraving or tracing the design, he utilizes the mīqāṣḥ, or knife resembling a blood lancet; and for putting lines on leather, the mīqāṣḥ, or tracer.141
(6) Among miscellaneous items used in connection with the application of gold, silver, ink, and paint, are the saqīl, or polisher called the dast, and the saqīl raṣqā, or finer polisher, of Ibn Badis. Qalqashandi uses nīqāṣāsh as the name of the instrument used to polish gold writing;142 and also uses saqīl, or saqīl raṣqā, for polisher and suggests that it be of copper. Sufyānī employs a māshāt, or shell, for this purpose. Other items are: the mīsārārah, or brush, and līf, or sponge.

Sewing

Islamic books were mostly frequently written on the loose leaves or sheets of the gatherings before binding. Even quite lengthy manuscripts, however, were not necessarily sewn and bound, but after writing might be simply collated in the correct order of pages, the edges trimmed to produce an even volume, and a portfolio constructed to house the whole unit. Such portfolios are often depicted in manuscript paintings where people are consulting or associated with books. They are usually modifications of the case bindings in which Islamic codices from the 11th century A.D. were covered; i.e., they consist of an upper and lower cover joined by a spine and with a fore-edge flap and pointed pentagonal

Fig. 5. A Mughal bookbinder working on a cover. Note the awl, leather knife and folders on his bench. Marginal painting from a leaf of the Jahangir Album, c. 1600-1619 A. D. Freer Gallery of Art, Smithsonian Institution, Washington, D.C., 54.116.
envelope flap as an extension of the lower cover—the portfolios have additional flaps which fold around the head and tail edge of the textblock. This structure might further be housed in a sleeve case open at head and tail, through which openings the portfolio-housed book can be inserted.

The gatherings making up the textblock were, however, normally sewn. The early Islamic bookbinders adopted the link-stitch sewing techniques used in the early Coptic and related binding traditions of the Middle East and Ethiopia and this basic form of sewing has been continued to the present day. Grohmann has observed that a small Arabic volume of the 3rd–4th century A.H. in the Rainier collection (Inv. Ar. Pap. 10130) has a sewing system identical to that of the Coptic binding from al-Ushānyn in the Staatliche Museen, Berlin (P. Berol. 14018).

We have further evidence in the form of sewing holes left in the spine folds of leaves of early Islamic codices and in the reference to sewing in the 11th-century A.D. text of Ibn Bādis.

The principle of link-stitch (sometimes termed “Coptic” or “chain stitch”) sewing is that, in order to connect the gatherings, at each sewing station the needle and thread are passed from the inside of the spine fold through to the outside and down so as to loop around the thread protruding from the corresponding sewing station of the gathering immediately below it, or penultimate to it in the sewing sequence. The rows of stitches connecting the gatherings on the spine of the book resemble the links of a chain after the sewing is completed. Although in Near and Middle Eastern codices of interrelated traditions (Coptic, Greek, Syriac, Armenian, Ethiop) a number of different link-stitch sewing styles have been recorded, in Islamic manuscripts from the mediaeval period to the 20th-century A.D. the sewing structure most frequently found has two sewing stations with a simple form of link stitch which picks up the adjacent preceding gathering (Figs. 6 & 7). Noteworthy in Islamic manuscripts is the frequent use of a sewing thread, of linen or often silk (frequently coloured), which is much too thin for the binding function it should perform, and which characteristically breaks down. Also usually only two sewing stations are used, unrelated to whether the format or weight of the book requires sewing support at more points.

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Fig. 6. Basic Islamic link-stitch sewing at two sewing stations.

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The gatherings are collated before sewing and the position of the sewing stations may be marked.

The stages of preparation and the sewing itself are described by Ibn Bādis:

You first begin in this craft by putting the portion, ḫāṣ (to be sewn) on a slab to the left; taking a gathering, kūfūṣ (plural kūfūrūs, kūfūrūs), at a time in the left hand and opening it with fingers of the right hand, place it on the slab and pass over its centre with the needle or folder, where the sewing of the thread will be done. Then you close it and cut the batin, or endsews, consisting of a double sheet, one page to be paged against the leather and the other remaining upon the quires to protect the book from harm and dirt. Then do the same with the rest of the quires (opening and going over the spine folds) until you come to the last. When you have finished that you prepare the thread for sewing. It should be fine and well-twisted, of about three strands depending on the gauge, since, if it is coarse thread, the sewed part becomes bulky and when the book is tightened in the press, the string bears the weight and a ridged impression is left: it is as if you took a string and wrapped it tightly around your finger to the end. Sewing may be done by several methods: one which the artisan employs for swiftness and speed, in which the needle pierces the quire in only two places, and another done with two or three stitches. Still another type is current with the Byzantines, but I am unable to describe it.

After the section is sewn, the thread is pulled and the sewn place pressed with the folder, nashū. Then says the author may God have mercy on him, First, that which begins the binding, after making the boards, is that he collates [from] the book, one after the other, and observes at the end of the paper and the beginning of the following one whether this consists of complete sections or was bound to begin with. When he finishes the collating and verifies the correctness and completion of the book let him then commence to gather the sections the one to the other and bundle it in parchment like what is found with the bundles, the old bundles and gather the parchment upon the book place it up on a smooth stone that is solid for beating.

He then describes the knocking down of the spine folds of the gatherings to minimize swelling:

And beat on the parchment with a heavy mallet weighing six pounds, or five, or four. In result of this beating is what befits the condition.