Chinese Turkestan, and their scientific examination, that the fact of the Chinese invention of paper early in the Christian era and its step-by-step migration westward to Europe was firmly established.8

(2) Travel of Paper Westwards

Only after paper was perfected as a writing material and became used in daily life in China, did it spread in all directions throughout the world. Its introduction to other nations occurred in two stages: first by the arrival of paper and paper products, later by the adoption of papermaking methods by that nation. From the available evidence, it seems that at least one to two centuries were required to develop local manufacture after paper products were first introduced. In its westward migration, for example, paper was introduced to the Arab world no later than the 7th century, but its manufacture there was not begun until the 9th century; it reached Europe in the 10th century, but paper mills were not established there until the 12th.

It has often been said that the Chinese kept the secret of their knowledge of papermaking until a few papermakers were captured by Arabs in the 8th century, but this is certainly not true.9 That the westward movement of papermaking was slow was due primarily to China's geographical and cultural separation rather than to secretiveness, for papermaking was learned by China's immediate neighbours as soon as they began to have contact with Chinese culture. The introduction of paper to Korea and Japan in the northeast and to Indo-China in the southeast was early, even though its migration to the west over the old silk road was slow and gradual. As archaeological evidence shows, the close a country lay to China proper, the earlier is paper to be found there.

The westward migration of paper started with Eastern Turkestan, where it crossed the Chinese border from Tunhuang, perhaps in the 3rd century. In the Loulan region, paper fragments of the 3rd century were found by Sven Hedin and Aurel Stein, and in the Turfan and Kao-chiang area, paper of the 4th and 5th centuries was discovered by Prussians and Japanese expeditions early in the 20th century, and by Chinese excavations in recent years. In the Khotan area, paper manuscripts in Chinese, Tibetan, Sanskrit, and the ancient Khotan languages, dated as 6th century, were found, also by Stein. While some of the paper documents may have been brought from China itself to this region, there is evidence that paper was manufactured locally. Among the documents found in

* Of Horrocks (1) p. 663 ff., also discussions below.
* Cf. Hunter (9), p. 68.
* The theory of Chinese secrecy about papermaking must have been based on the fact that it was a secret early in Europe, where paper mill owners sometimes required their staff of factory workers to guard the secret of the craft against possible competitors, or applied for a patent for monopoly of raw materials as well as the manufacture of paper; see Hunter (9), p. 239-43, and discussions on pp. 320 ff., below.
* Cf. below, p. 341 ff.
* For discovery of early paper specimen, see Conrad (5); pp. 85, pp. 107; Schindler (45, p. 239); Stein (11), p. 133, 271; and a summary in Tien (18), pp. 147-53.

Turfan in 1792, one dated to 620 bears the name of a papermaker, chih shih Wei Hsien Nu, along with names of administrative officers of Kao-chiang. Again, another piece has a message about sending prisoners to work in paper factories, which must therefore have been operated locally. After studies by Chinese scientists of a score of paper documents discovered in recent years, it is believed that some papers in this region were made locally no later than the beginning of the 5th century.10 As to the Tibetan manuscripts mentioned earlier, it was learned that the raw fibre is not native to Sinkiang and may have been imported from Tibet.9

Paper probably moved farther westwards to the Arab world before the 9th century. Trade and other contacts between Arabs and Chinese furnished opportunities for the Arabs to know paper quite early, and such Arabic words as hagag for paper and its equivalent girta, which is found in the Koran, are believed to be of Chinese origin.11 As early as 650 Chinese paper was imported to Samarkand, but it was a rare article used exclusively for important documents, and it is generally believed that its manufacture in the Arab world was not begun until the middle of the 8th century. It is also said that in the battle on the banks of the Tigris River in 751, when the allied Turkic-Tibetan forces routed the Chinese army of Kao Hsien-Chih, and captured the prisoners, among them were various craftsmen, including papermakers, who were taken to Samarkand to start paper manufacture.12 Abundant crops of hemp and flax and the water supply from irrigation canals provided the natural resources for the paper industry at Samarkand, and manufacture grew; not only was the local demand filled, but ‘paper of Samarkand’ became an important article of commerce.13

From Samarkand the paper industry soon passed to Baghdad, where a second paper mill was established by Chinese workmen around 791. As well as a religious and cultural centre of Islam (Fig. 1 197), Baghdad was then one of the richest cities of the world, and from this time, paper replaced parchment as the major writing material; the Arabian supply of the European market continued until the 13th century.14 Another papermaking centre in Western Asia was established at Damascus, which supplied paper known in Europe as charts damacona, as well as products of its other handicrafts, for many centuries. Another Syrian town, 4 Phan Chi-Hoing (176), pp. 137-8, 148.
* Seitz (11), p. 476.
* Birth of the Arabic word kahag for paper can be traced to the Chinese term ba-eh, paper mulberry paper. S. Mahdabian (3), p. 148 ff., says hagag and girta are synonymous, meaning paper primarily and document secondarily, and that girta represents an earlier borrowing.
* Cf. Lauer (11), p. 359.
* While the Arabic source says that paper was brought to Samarkand by Chinese prisoners, the Chinese history records the battle without mention of papermakers as prisoners. In an account by Tu Hui13, who was one of the prisoners and who returned to China in 751, he mentioned several names of weavers, gold- and silverworkers, and painters among prisoners, but no papermakers; see his Ching Hong Chi'1 (CHIB), p. 287 ff., Pelliot (32).
* C.F. Hewitt (1), pp. 150-4, also Carter (13), p. 733, citing the statement by the Arab writer Tu Shih of the 11th century.
* Yao Ching-Hoing-Wu (1), p. 82.
* 今番制版 tutto."
Bambyn, also was known for its paper, which was mistakenly thought to have been made of cotton or bombicina.9

Paper migrated from Asia to Africa in the 9th century, and gradually replaced papyrus as the major writing medium. The content of the Raisner collection in Vienna, which includes some 12,500 documents in papyrus and paper, indicates that all documents before 800 were written on papyrus; after that, the later the date the more paper was used.3 Towards the end of the 19th century, paper was evidently more popular than papyrus, and was also used for wrapping; rags became treasured as the raw material. Toward the middle of the 10th century, paper entirely displaced papyrus as writing material, as in China it had replaced bamboo and wood since the +3rd century. The northwest coast of Africa became familiar with paper probably in the 9th or 10th century, following the Arab conquest of Morocco, where the capital, Fez, became a centre of papermaking. But Fez lay in the strategic area that marked the struggle between the Arabs and the Spanish, and it was from this region that paper was introduced to Europe.5

Paper could have entered Europe by two different routes: one through Spain, the other by way of Italy. Documentary evidence shows that Spain was the first European country to have it for writing as well as to develop a flourishing paper industry. With the Arab conquest of the Iberian peninsula, paper appeared in

Spain no later than the 10th century, and a manuscript of the 10th century found in Santo Domingo is said to be one of the earliest examples of paper there; it is made of heavy, long-fibre linen rags and sized with starch, and thus similar to Arabian papers. The Moors introduced its manufacture there, probably early in the 12th century, and one old manuscript dating from 1129 was written on paper as well as parchment; the paper is believed to have been either imported to or made in Spain.4 The first Spanish paper mills were established in the city of Xàtiva, which was famous for its flax, and an Arab traveller wrote in 1150 that paper manufactured there was better than any from elsewhere in the civilised world; it was sent to both East and West.8 The early mills were operated by Arabs, but after the Christian conquest by local people, and the first paper factory run by Christians was built in 1157 in Vidalon near the French border. Many Spanish Jews were also skilled in this craft, and after the conquest of the kingdom of Valencia, Jewish papermakers continued to work there, though a tax was levied on their product.6

Paper entered Italy not from other European nations but from the Arab world, perhaps from Damascus by way of Constantinople and Sicily. Appearing as early as the 12th century, several old Italian manuscripts still exist which show the early use of paper in Italy, while it is known to have been prohibited for official use in 1291; indeed, a legal ruling in Sicily stated that documents written on paper would have no authority.4 All paper referred to must have been imported, since none was manufactured locally until more than a century later.

The earliest paper mill known to have been established in Italy is the one at Fabriano in 1268–71, which still continues in operation today. Originally it was a most important source of fine rag paper, and several innovations arose there. Its pulp was made of short fibres thoroughly ground with metal beaters, the paper was sized with an animal glue, and watermarks with crosses and circles were introduced in 1282.9 All these factors contributed to the excellence of the Fabriano paper, and were soon adopted by other European papermakers, especially at paper mills established in other cities in Italy, which included Bologna (1293), Cividale, Padua, and Genoa. As a result by the time the 14th century had dawned, Italian paper surpassed, in production and quality, that from Spain and Damascus.

In France, paper was probably introduced from neighbouring towns in Spain, for there was a close affinity between the two countries. Spanish paper was used in France at the beginning of the 13th century, but French papermaking started in the 14th, for a mill is known to have been established near Troyes in 1348, and others were set up at Essonne, Saint-Pierre, Saint-Cloud, and Toulouse between 1354 and 1388.11 However, a legend relates that Jean Montgolfier was captured by Turks during the second Crusade and put to work at a paper mill, from which he escaped and returned to Europe in 1157. His grandson, it was said, established several

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9 The name shatū šâmīye, paper of Bambyn, was corrupted to shatū šâmīye, paper of cotton. In 1897 this description was proved incorrect by J. Karabacek and J. Wieger through scientific analysis.


5 C. Blum (1), pp. 241ff.; Yao Chihung Wu (1), p. 84.

8 Ibid. p. 176, citing a statement by El-Kedisi.

9 Ibid. pp. 27–9.


11 Blum (5), pp. 57–5.
paper mills at Ambert in the Auvergne, and certainly this became an important centre for papermaking in the middle of the 14th century.4

Germany used paper early in the 13th century, mostly imported from Italy, and manufacture was not begun there until the end of the 14th century, when a mill was established by Ulman Stroemer (Fig. 1198), who, apparently, had learned the trade from Italians, two of whom collaborated with him in setting up his mill in Nuremberg in 1390.5 Stroemer used the letter S as the watermark of his products, and it was his mill which, in 1391, suffered the first labour strike in the paper industry.6 It was around this time that the demand for paper increased due to woodblock printing being introduced to Nuremberg, and rose more rapidly still after the introduction of typography in the middle of the next century (Fig. 1199).

In the Netherlands, paper is known to have been used in 1322; the oldest paper found in Dutch archives is dated to 1536 and has been preserved at the Hague.7 A paper mill is said to have existed in 1436, but the industry was not well established until 1580, when two noted papermakers were authorised to manufacture the

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8 Hunter (g), p. 473; Kapici (i), pp. 7–8.
9 Blum (i), p. 23.
10 Hunter (g), p. 154.
11 Ibid. p. 474.

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Fig. 1199. Earliest picture of papermaking in Europe. This woodcut by Jost Amman printed in Frankfurt in +1550 shows tools and processes remarkably similar to those used by early Chinese papermakers, cf. Figs. 1071–2. From Hunter (g).

product near Dordrecht. The Eighty-Years War of 1568–1648 resulted in the migration of many craftsmen to Amsterdam, which had become an international trade centre by the close of the 16th century, and improved paper production after the important invention in +1680 of the Hollander beater for the maceration of
raw materials. Switzerland was content to import most of its paper from Italy and France until the middle of the 15th century, but then the proceedings of Church councils required a large amount of paper for record-keeping, and a paper mill was established in Basel in 1456; many others then followed in the same area, which became a papermaking centre.

In England, paper is known to have been used for written transactions at the beginning of the 14th century, much later than on the continent. It must have been imported, perhaps from Spain, for as late as 1436, the famous early printer William Caxton at first used only papers imported from the Low Countries. However, a paper mill was established before 1455 by John Tate in Herefordshire, and another by Thomas Titherby at Fen Ditton in 1557, though the best known of the early mills was the one set up in 1588 at Dartford in Kent, by Sir John Spilman. Spilman was a jeweller to Queen Elizabeth, and he managed to obtain a patent in 1589 that gave him a monopoly throughout the kingdom for collecting all kinds of rags for making white writing paper. Towards the end of the 17th century, some one hundred paper mills were operating in England.

Paper did not reach certain other parts of Europe until the latter part of the 15th century. The first mill in Poland was established in Crakow in 1491, with others in Wilno (1526) and in Warsaw (1534). Paper may have reached Russia early, but the first mill there was not established until 1526, and workmen were recruited from Germany when an extensive mill was set up in 1719. By 1801, there were some twenty-three mills operating in the Russian Empire.

Paper reached the New World probably in company with the early explorers in the late 15th or early 16th century. Paper books doubled together in folds like Spanish cloth were mentioned by Juan de Grijalva who arrived in San Juan de Ulua in 1518. These were probably a kind of quas-paper made by beating fig or mulberry tree bark that had been used by the Mayas and Aztecs for writing. The manufacture of true paper was introduced to America by European papermakers in the latter part of the 16th century, when a twenty-year concession was granted by the Spanish court in 1575 to two papermakers to 'manufacture paper in New Spain'. In 1580 they set up a mill at Culhuacan near Mexico City, the first to be built on the American continent.

Paper used in colonial America north of Mexico was imported from Europe, mostly from the continent, before being locally manufactured in the late 17th century, when the first mill in northern North America was built in 1690 near Germantown, Philadelphia, by a German immigrant, William Rittenhouse, who had learned the craft in his native country. Only two years after his arrival in Philadelphia Rittenhouse, with a group of others in the German settlement, started paper manufacture. At the beginning of the 18th century two other mills were established in Pennsylvania: one in 1710 by William de Wes, a relative of Rittenhouse who probably learned the craft at his mill; another, the Ivy Mill, in 1729 by Thomas Wilcox, an English immigrant, at Chester Creek near Philadelphia. Many workers from Wilcox's mill later established their own mills for the manufacture of paper in neighbouring areas.

The paper produced at the Ivy Mill supplied the growing printing and publishing activities in Pennsylvania and New York. One of those most involved with it was Benjamin Franklin, who though primarily a printer was also interested in the development of the American paper industry and in improving papermaking methods. He presented an essay on this subject, criticising the European method of making large sheets of paper by pasting small sheets together and burnishing the joints with an agate or flint. He described the Chinese manner of making sheets as large as twenty feet by six feet, by two workmen, who dried these upon the flat, inclined sides of a heated kiln, making a remarkably smooth surface. After a detailed description of the Chinese method, Franklin concluded: 'Thus the great sheet is obtained, smooth and sized, and a number of the European operations saved.'

In Canada, paper was imported primarily from the United States and Europe, before its first paper mill was established in 1803 at St Andrews, Quebec, by Walter Ware from Massachusetts. A little later, another was built in 1819 by R. A. Holland at Bedford Basin, near Halifax, the increasing need for large quantities of paper for printing newspapers probably being the incentive for this local production of paper. This was true, too, in Australia, where the first paper mill was established near Melbourne in 1868. By this time, papermaking had completed its journey from China to every corner of the world.

(3) Introduction to Printing in the West

The travel of paper from China westwards to Europe by way of the Arab world can be traced step by step, but the spread of printing, on the other hand, is not so clear. Such information available indicates that it might have taken the same route to the West overland by way of the silk road or by sea, though at a much later date than paper. Printing appeared in Central and Western Asia as well as in Africa before it was known in Europe, while printed matter, including playing cards, printed textiles, woodcuts, and books printed from woodblocks, is known to have existed in Europe before Gutenberg. Although no direct relationship has yet been established between European typography and Chinese printing, a number of theories in favour of the Chinese origin of the European techniques have been advanced. Some of them are based on early references, others on the circumstantial evidence...
that close contact between the East and West, especially during the Mongol conquest, provided a Chinese background for the European invention of typography.

In a way similar to the migration of paper to the West, printing probably first crossed the northwestern border of China to reach Eastern Turkestan. This region, known as Turfan, was occupied by Turkic people from the +6th century and came under Chinese domination a hundred years later. In the middle of the +8th century, however, the area was conquered by the Uighurs, a Turkic tribe, which established an empire that lasted almost five hundred years, until they submitted to the Mongols at the beginning of the 13th century. During the Uighur period, Turfan was a place where many religions and cultures mingled, as discoveries by Prussian, Japanese, and Chinese expeditions during this century of documents in seventeen different languages, and other cultural relics testify. The documents found are mostly religious texts and commercial papers, including many examples of blockprinting in Uighur, Chinese, Sanskrit, Tangut, Tibetan, and Mongol, and correspond to the languages found in the Tunhuang documents.

The Uighur prints are all translations of Buddhist works in the Sogdian alphabet with occasional introductory matter by Uighur scholars. What is so interesting is that some of the books have titles and page numbers in Chinese characters (Fig. 1200), indicating that the blocks must have been carved or printed by Chinese craftsmen who used the characters for identification in handling and binding. The Chinese books also are Buddhist sutras printed in large characters and bound mostly in the folded format, with some in rolls as was the fashion in China. A Sanskrit sātra in Lanna script, probably from the +4th century, has been found too; it is in the padma form with two long, narrow sheets pasted together. Also included are Tibetan charms contained in hollow clay Buddhist figures, Mongol prints in the Thang-pa script, woodcut pictures, and some materials in the Tangut language. The Tangut people established an empire from the +11th through to the early +13th century in northwestern China, bordering Turfan, and used both blocks and movable type extensively for printing.

Both movable-type prints in Uighur and block-printing from the Turfan area have also been discovered on other occasions. The Chinese expeditions in 1928–30 found three additional printed fragments of Buddhist texts in Chinese, two of which are written on the back of the paper in the Uighur language and bear a Chinese seal in red. Also a font of several hundred wooden type for the Uighur language (Fig. 1201), dating to about +1300, was discovered in Tunhuang. This shows that

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* The items found by Albert Grunewald and Albert von LeCoq of the Prussian group in the Turfan basin in 1907–19 were kept in the Museum für Volkerkunde, Berlin, and are said to have been partly destroyed during World War II. For a more detailed description of documents from the Turfan region, see von LeCoq (5), p. 64; Carter (1), pp. 101–6; Huang Wen-Pi (5).

* For the Tangut printing, see Goodrich (2), pp. 49–52; also pp. 162ff., above.

* The Chinese-findings are included in a report by Huang Wen-Pi (7).

* The Uighur type were found by Paul Pelliot in 1907, cf. Carter (1), pp. 136ff., 118. A recent report says the set can no longer be located.

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Fig. 1200. Printing in mixed Chinese, +1300, found in Turfan, bear features in Chinese. (a) Buddhist text in Sanskrit but titles and colophon in Chinese characters on the right side. (b) Buddhist text in Uighur with Chinese characters on the left margin. (c) A sātra in Thang-pa script with pagination in Chinese characters at the centre folding line. Museum für Volkerkunde, Berlin.
conversion from block printing to movable type is natural for an alphabetic
language such as Uighur, and not only European languages.

The introduction of printing farther to the west was probably accomplished by
the Uighurs during the Mongol period. After the Mongol conquest of Turfan, a
large number of Uighurs were recruited into the Mongol army; Uighur scholars
served as Mongol brains, and Uighur culture became the initial basis of Mongol
power. If there was any connection in the spread of printing between Asia and the
West, the Uighurs who used both block printing and movable type had good
opportunities to play an important role in this introduction.

The Mongol conquests incorporated Persia into an empire of which the capital
was in China. Thus the Chinese cultural impact on Persia was manifest during the
middle of the 13th and the early part of the 14th century. It was here that printing
in China was first reported in literary works and was first used in western Asia. As is
generally known, paper money was printed in Tabriz in 1291, exactly following the
Chinese system, and even the Chinese word chuan for money was adopted, and
subsequently incorporated, into the Persian vocabulary. Although this monetary
system did not last long in Persia, the wood carvers who had been employed for the
enterprise may have been engaged in printing other material not known to us.

The earliest description of the methods of Chinese printing in any literature was
given by a Persian scholar-official, Rashid-eddin, prime minister under the
Mongol ruler Ghazan Khan, who took ten years, from 1301 to 1311, to complete a
history of the world, that included a description of the reproduction and distribu-
tion of Chinese books. Rashid said that when any book was desired, a copy was
made by a skilful calligrapher on tablets and carefully corrected by proof-readers;
whose names were inscribed on the back of the tablets. The letters were then cut out

Fig. 1202. Wooden types and impression of Uighur script, c. 1290, found at Timbarchan. From Carter (1).

by expert engravers, and all pages of the books consecutively numbered. When
completed, the tablets were placed in sealed bags to be kept by reliable persons, and
if anyone wanted a copy of the book, he paid the charges fixed by the government.
The tablets were then taken out of the bags and imposed on leaves of paper to
obtain the printed sheets as desired. In this way, alterations could not be made and
documents could be faithfully transmitted. A few years later the same description
of Chinese printing was incorporated into a work by an Arab author. Thus the
Chinese method of printing, including the various steps of transcribing, proof-
reading, cutting blocks, printing, and distribution, were for the first time carefully
recorded.

Despite the fact that the Islamic religion did not favour printing, some fifty pieces
of printed matter, believed to have been made between 1290 and 1330, were
found in Egypt toward the end of the 13th century. These are all fragments of
Islamic prayers, charms, and texts from the Koran in old Egyptian script (Fig.
1202). Except for one in red, they are printed on paper in black ink, though not by
pressure but by rubbing with a brush in a way similar to the Chinese method.
Judging from the materials used, the religious nature of the documents, and the
printing techniques used, experts believe that these printed specimens are
connected with printing in China and Central Asia rather than an independent
development. The time of the transmission to Egypt is uncertain, but scholars
inclined to a comparatively late date, after the time printing in China had begun to
come across Turkestan to the Arab world during the Mongol conquest. It could
have been introduced through Persia or by travellers or traders on other routes, since
Chinese intercourse with North Africa was very close in the early part of the
+14th century. After the submission of the Uighurs in 1206, the Jurchens and Koreans in 1231,
and the Persians in 1243, the Mongol army moved farther north to overrun Russia
in 1240 and to invade Poland again in 1259 and Hungary in 1285. They thus
reached the border of Germany where block printing appeared not long after the
climax of the Mongol conquests. Along with the military expansion, commercial,
diplomatic, and cultural relations developed between Europe and Mongol China
during the 13th and early 14th centuries; overland highways connecting China,

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6 The method of Chinese printing had never been recorded by any Chinese writer until modern times. This
description by Rashid-edin, although brief, is probably the earliest record of the techniques of Chinese printing
in any language including Chinese.
7 Over 100,000 items of documents in six different languages, dating from the 13th to the +14th centuries, on
papyrus, parchment, and paper, excavated in the ruins of an ancient city in Egypt, are kept in the Ptolemaic
Riueri Collection of the Amman National Library in Vienna, and additional items are held in Heidelberg, Berlin,
8 A Hebrew block print from the late 14th century has recently been found and studied by the Taylor-
Schneider Genizah Collection of the Cambridge University Library. It is believed that the Jews of Egypt might
also have adopted the method of block printing used by the Egyptians at the time. I am grateful to Dr. L. G.
9 See discussion in Carter (1), pp. 139–40.
10 The travels of Ibn Battuta (id. 1355) in Yule (2), iv, pp. 1–86; also Davenport (8).
Persia, and Russia were built to help the flow of increased traffic in the way of couriers, caravans, craftsmen, and envoys. In 1245 an embassy was sent to the Mongol court by the Pope, who received in reply a letter with a seal carved by a Russian in Chinese characters and impressed in red (Fig. 1203). Soon after, in 1246 and 1253, two other embassies were sent by the King of France and, as we have seen, one of the envoys, William Rubebreck, was the first European to report on the use of paper money in China. The same practice, described by Marco Polo in the record of his travels, was somewhat later, but after Polo left China in 1295, John of Monte Corvino, a Roman Catholic missionary, was sent there by the Pope, and stayed for over thirty years until his death in 1326. He and other missionaries worked in Peking, Fukien, and Yangchow, building churches, learning the language, translating the Bible, and preparing religious pictures as aids to preaching Christianity. Since the printing of Buddhist pictures was very common

* Carter (1), pp. 190-60. The seal of state, measuring 15 cm. square, bears inscriptions reading ‘Ha Kuo An Min Chih Pa’ (Emblem for Protection of the State and Pacification of the People).
* Roman Catholic tomb tablets dated to 1532 from Chibusheew, Fukien and to 1542 and 1544 from Yangchow, Chihchou were recently found, indicating a sizable European community in China under the Mongol rule, with Catholic converts estimated at 30,000 to 100,000 at the time; see Rooflex (1), pp. 346ff, Heilai Na (2), pp. 321f.

in China before and during this time, the use of this simple and convenient method for reproducing the translated Bible and religious pictures would have been natural. As these materials were required in large numbers of copies for circulation both among Chinese Christians and among non-converts, it would be surprising if they were not printed. If they were, then the sudden appearance of religious prints and block books in Europe in the early 14th century can be reasonably explained.

Before the use of typography in Europe in the middle of the 15th century, various kinds of printed matter were already there, as early perhaps as a century or more before Gutenberg. There were playing cards, printed textiles, prints of religious images, and block books, all of which involved the use of wood blocks for duplication. Among these, playing cards were one of the earliest examples of block printing to appear in Europe, doubtless because of their early and widespread use in the East. For card games were played in China before the 9th century, at the time when books were evolving from paper rolls topaged form, and they spread over much of the Asian continent before the Crusades. Probably they were brought to Europe by the Mongol armies, traders, and travellers, some time in the early 14th century. Fig. 1204), references to their earliest appearance being 1377 in Germany and Spain, 1379 in Italy and Belgium, and 1581 in France. Because card games were played in all sectors of society, their popularity demanded the reproduction of playing cards in great quantity, though the craze for gambling

* The close resemblance in technique and appearance between European and Chinese block printing is further discussed below, pp. 317ff.
* See discussion of playing cards in China on pp. 311ff above.
* An Italian writer, Valeri Zani, of the 13th century said that Venice was the first European city in which Chinese cards were known, cf. Carter (1), p. 191 n. 24.
printing on paper. Since the method is identical, the transfer from one material to the other is simple, since textile printers and the early block printers in Europe were closely connected. Professional wood carvers could of course, be employed for printing on any material. The technique of carving blocks for printing on textiles was in fact exactly the same as that for paper. The same kind of wood was chosen, the transfer of design from paper to block, the manner of cutting in relief, and of placing cloth on the block and pressing it with a burnisher or pad stuffed with homehair were all the same. If a piece of paper is substituted for a piece of fabric, the result is printed paper.

The earliest specimens of printed textiles extant in Europe are those from France and Germany dating back to the +6th or +7th century, even earlier than those from Tunhuang and Turfan. However, a recent discovery of silk fabrics at Ma-Wang-Tui, Chiangsha, indicating printing on textiles of a set of continuous patterns, goes back as early as the 2nd century. Whether European textile printing was influenced by the Chinese is not clear, but some patterns of Chinese origin, borrowed by Persian weavers, are said to have been transmitted to Western Europe, and certainly many Chinese decorative motifs had been successfully copied by European makers of figured fabrics before 1500.

Religious pictures and block books provide the closest examples of printing before Gutenberg. Similar in nature, and differing only in format, when single sheets of image prints were collected together, they naturally evolved into book form. The image prints were first produced in southern Germany and Venice and gradually spread over most of central Europe between 1400 and 1450. Their subject-matter is exclusively religious, including pictures of certain sacred personalities or representations of biblical stories with legends in Latin engraved at the foot of the sheet or in cartouches proceeding from the mouths of the principal figures.

Most of the several hundred image prints still in existence are undated, but they are believed to have been produced during the latter part of the 15th century and early part of the 16th century. Although a few have some artistic merit, most of the pictures are crude in style and workmanship. They were printed in outline and filled in with colour by hand or by stencil, but all the same they may possibly have some connection with Chinese printing, since we use of block prints for Buddhist pictures had long been practised in China. Many such single-sheet prints with Buddhist figures and legends were discovered in Tunhuang, and printing of tens of thousands of such pictures on silk and paper are recorded in literary sources. A Then,

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4 De Vries (1), pp. 107 ff., cites an expert opinion that engravers made blocks to print cards, images, and other printed matter such as wallpaper, cf. also Carter (1), p. 107.
7 See KETTH, 1979 (no. 51), p. 474.
10 Cf. description of individual specimens in De Vries (1), pp. 69-77.
11 But pp. 54-64, the Chinese origin of image prints was suggested, but there were no early specimens to offer as evidence; cf. also Carter (1), p. 206.
12 Cf. discussion on pp. 15-16, above.
in the 14th century when European missionaries were sent to China, they made use, it is said, of religious pictures for distribution to the ignorant. It is possible, therefore, that these old practices for religious propagation in China were borrowed for similar purposes in another land.

At first, each picture was printed on a single sheet, or sometimes pictures were paired on one sheet, but later, some were pasted back to back or printed on both sides of the paper and gathered into books. The block prints that have been preserved include some containing pictures with text (Fig. 1205) and some having pictures alone; only very few have text alone. They were prepared not by priests or

in monasteries, but by independent printers who sometimes also produced playing cards, image prints, and even textiles. The demand for block printed books was probably very great, as the few such books still in existence are known to have been published in numerous editions, and their production continued after typography came into fashion. This was probably because block books were familiar to users throughout Europe, they cost less to produce, and block carvers were there to continue their traditional way of business until their generation passed away.

The close resemblance between the early block books of Europe and those of China is probably the most convincing evidence that European printers followed Chinese models. Not only were the methods of cutting, printing, and binding similar, but also the materials and the manner in which they were used. It is stated that the wood used in European xylography was cut parallel with the grain in flat blocks. Moreover, the material to be printed was transferred from paper to the woodblock on which it was fastened with rice paste, two pages were engraved on one block, water-based ink was used, the impressions were taken by means of friction on one side of thin paper, and the double pages were put together two by two with the blank sides folded inside. All these procedures were not only exactly the same as the Chinese methods, but were contrary to prevailing European practice. The European method was usually to cut wood across the grain, to employ oil-based inks, to print on both sides of the paper, and to use pressure rather than rubbing.

Robert Carvon, Baron de la Zouche (1810–73), has said that the European and Chinese block books are so precisely alike, in almost every respect, that "we must suppose that the process of printing them must have been copied from ancient Chinese specimens, brought from that country by some early travellers, whose names have not been handed down to our times." Since all the technical processes are of Chinese rather than European tradition, it seems that the European block printers must not only have seen Chinese samples, but perhaps had been taught by missionaries or others who had learned these un-European methods from Chinese printers during their residence in China.

(4) Chinese Background of European Printing

While Chinese paper was mentioned by European travellers as early as the 13th century, the art of printing in China was not clearly recorded in European literature until some three centuries later. Only after the accomplishments of Gutenberg and other printers became known in the middle of the 15th century, did European writers begin to record the invention and look into the origins of
printing. The fact that printing was used in China several centuries before it was in Europe was acknowledged by historians and scholars, who also offered the opinion that European printing was influenced by the Chinese, and although none of their theories have been substantiated further, neither have they been disproved. On the other hand, these earlier opinions have provided some incentive for later scholars to try to trace possible Chinese connections with European printing, and while no concrete proof has yet been presented, circumstantial evidence is strong. Today, even one who believes that printing in Europe in the 15th century was an altogether independent outgrowth of its own times and conditions, has acknowledged that 'Europeans in their varied contacts with the Orient learned something of printing and perhaps even saw documents and books printed on paper.' Almost all defenders of an independent origin of European printing emphasize technical differences between Chinese block printing and typography, but not the cultural considerations offered by many earlier and later writers.

The question of who was the inventor of printing was raised as early as the beginning of the 16th century by García de Recendo (c. 1470–1536), a Portuguese poet who, incidentally, refers in a poem to the question of whether printing was first discovered in Germany or China. But it was not until the middle of the century that Europeans began to write books on printing and to notice that printing had been used much earlier in China. The first to make a clear mention of Chinese printing was the Italian historian Paulus Jovius (1483–1552), who noted that printing was invented in China and introduced to Europe through Russia. In his Historia sae temporis, published in Venice in 1546, he wrote:

There are there (Canali) printers who print according to our own method, books containing histories and rites on a very long title which is folded inwards into square pages. Pope Leo has very graciously let me see a volume of this kind, given him as a present with an elephant by the king of Portugal. So that from this we can easily believe that examples of this kind, before the Portuguese had reached India, came to us through the Seychuan and Muscovites as an incomparable aid to letters.

Jovius had originally studied medicine but he was close to the political and religious powers in Italy, so he was sent as ambassador to Moscow not long after Russia was freed from Mongol domination, and wrote a history and several other books about Russia. He may also have had some knowledge of China, as we are told that

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1 The first work on the invention of typography, De Typographia Inventio, was written by Matthias Richter and published in Copenhagen in 1586; and to less than four similar titles were published in the 16th century, see list in McMurtrie (1), p. 136.


3 See Mertens de Romaine (ed.), Garcia de Recendo: Miscellanea... (Caire, 1957), p. 69, and in which number 175 implies the question of priority of this discovery; Lach (3), n. 2, p. 118, 117.


5 Later opinion was apparently used by many European writers of the 16th and 17th centuries without acknowledgement. His name was perhaps first mentioned by Richard Smith in his unpublished manuscript of 1570, cited 0f the First Invention of the Art of Printing, which states that printing was used by the people of China in the unison parts of the East some ages before it was known in Europe, and that art came unto us by the Seychuan and Muscovites before Portuguese came into India; see Smith (1), p. 16.

6 For several Chinese books and maps together with their translations were sent to him by the Portuguese historian João de Barros (1498–1570). With his professional and academic credentials, his statements concerning Russia therefore carry considerable weight', as Carter has remarked, and even though he gave no references for his claims about Chinese printing, as a historian he must have had some evidence to support his statements, of course that evidence might have seemed too obvious to need mention in a general history, for contacts between East and West had been so frequent during the period of the Mongol conquests, not long before his lifetime.

A little later, Gaspar da Cruz and Martin de Rada, the two early visitors to China whose comments on paper were mentioned earlier, also made some remarks on Chinese printing. Cruz said that 'it is over nine hundred years since the Chinese have used printing, and that they not only make printed books but also different figures.’ In saying this, he was the first European visitor to China who indicated a period for the earliest use of printing not only for books but also for pictures or illustrations. Theories that printing originated in the Sui or early Tang in the 6th or 7th century were generally spoken of in the latter part of the Ming dynasty, the time when Cruz was in China, while numerous books printed with illustrations or separate sheets of pictures would also have been available to him.

Rada mentioned Chinese printing in his reports and also brought back to Spain a number of Chinese books. He talked with a Chinese official who ‘was greatly surprised to learn that we likewise had a script and that we used the art of printing for our books, as they do, because they used it many centuries before we did.’ He also acquired many printed books of all the sciences, both astrology and astronomy, as well as physiology, chiroiomy, arithmetic, and their laws, medicine, fencing, and of every kind of their games, and of their gods. Among the books brought from China were eight local gazettes, in which, he noted, such precious metals as gold and silver were recorded.

From this time on, similar statements were made by many other writers, including Juan Gonzalez de Mendoza, whose most comprehensive and authoritative work on China published in 1585 devoted two full chapters to Chinese books and printing. In one of these, ‘The substance and manner of these books that Friar Herrada and his companions brought from China, de Mendoza describes in categories all kinds of books he acquired there. The list includes

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* CE Boer (1), p. 190.
* CE Carter (1), p. 159.

* The earliest suggestion that Chinese printing originated in the Sui dynasty (581–618) was made by a Ming scholar, Liu Shou (1777–1833), whose theory that wood blocks were carved in 553 had great influence on later opinions; see discussion on pp. 118ff. above.

* Two reports 'Narrative of his mission to Fukiin (June–October, 1735)' and 'Relation of the things of China which is properly called Chinees' written late 1735, or early 1736, are translated in Boer (1).

* Boer (1), p. 205.


* Ibid, p. 261, mentions that 'seven of these books came into our hands', but eight different titles are described on pp. 292 ff.

* 同上。
history, geography and gazetteers, chronology, navigation, ceremonies and rites, laws and punishments, herbs and medicine, gods, origins, astronomy, biographies of famous persons, games, music, mathematics, architecture, astrology, chiaroscuro, physiognomy, calligraphy, divination, and military works. All these books must have been read with the help of native Chinese in the Philippines, where the missionaries stayed. As Mendoza wrote, "they (francos) had bought a good number, out of which are the most things that were thus put in the small historie." Interestingly, a few Chinese books of the 16th century survive in libraries of Spain and Portugal.

In another chapter, "Of the antiquity and manner of printing books, used in this kingdom, long before the use in our Europe," he discusses the admirable invention of printing in Europe in 1438 by John Gutenberg of Germany, whence the same invention was brought into Italy. He added:

But the Chinos do also affirm, that the first beginning was in their country, and the invention was a man whom they reverence for a saint: whereby it is evident that many years after that they had the use of it, it was brought into Almaine by the way of Russia and Moscovia, from whence, as it is certain, they may come by land, and that some merchants that came from Arabia Felix, might bring some books, from whence this John Gutenberg, whom the histories doth make author, had his first foundation.

It is interesting to note that, besides his claim that Gutenberg was influenced by Chinese printing which came by way of Russia, he also mentioned another route, through trade from Arabia by sea. He concluded:

The which being of a truth, as they have authorise for the same, it doth plainly appeare that this invention came from them into us: and for the better credite hereof, at this day there are found amongst them many books printed 500 years before the invention begun in Almaine: of which I have one, and I have seen others, as well in Spaine and in Italy as in the Indies.

Mendoza's generalisations concerning things Chinese had great influence on some later writers, and throughout the 16th century, such authors as the eminent French historian Louis le Roy (1510-77), Francesco Sansovino (1521-96), a renowned poet and translator, and Michel de Montaigne (1533-92), a brilliant essayist, all repeated the same story that printing originated in China several hundred years before it reached Europe, and inspired Gutenberg's invention.

Besides these opinions, which seem to have all derived from Jovius's account, there is a different view which points to direct and personal contacts with Chinese printing. This alternative theory relates to an Italian engraver, Pancirolli Castalli (1538-1490), who in 1688 was commemorated by a statue in Lombardy honouring him for having introduced typography to Europe. He is said to have been born at

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32. PAPER AND PRINTING

Feltre, a town northwest of Venice, and to have used wooden movable type after having seen Chinese books brought from China by Marco Polo. In 1456 he printed at Venice several broadsides which are said to be preserved among the archives at Feltre. The tradition goes on to say that Gutenberg, whose wife was of the Venetian Contarini family, had seen printing blocks brought from China to Venice, and by development of this inspiration arrived at the invention of printing. This story was given by the Robert Carzon, in two accounts to the Philobiblon Society of London in 1853-54, citing a newspaper article by a Dr Jacopo Facen of Feltre in 1843. The same story is included in several editions of Marco Polo, and Henry Yule, the eminent translator of Polo's works, was disinclined to the view that this tradition was correct, though he believed that many a traveller and overland trader may have brought home Chinese wood blocks.

While many authors suggest the Chinese origin of printing and its influence on European typography, there are some who hold a different opinion, not disputing the cultural theories, but basing their contention primarily upon technical differences between Chinese and European methods. An early expression of this view was made by Guido Pancirolli (1523-95), an Italian scholar and author, who believed that Gutenberg's movable type differed in technique from Chinese printing. He said that "typography is old in China, but as found out in Mentz, it is a modern thing." He did not specify what the differences were between the two, but implied an improvement of modern technology over the old method. As explained by André Blum, a respected author on the origins of paper and printing, "The essential element in the invention of printing in the West is not that it was derived from wood block printing, … but that it consisted rather in the creation of movable characters made from a fusible metal." He said that three things are needed for typography: a matrix or mould in which the letter is engraved in intaglio, an alloy cast in the matrix, and a reproduction of the character in relief on the punch. Actually, a similar method of casting metal types from punches was used in the Far East at least half a century before Gutenberg and there are theories that typography could have derived from there. As G. F. Hudson says: "Since Korean typography underwent so remarkable a development just before the appearance of the process in Europe, and there were possible lines of news transmission between the Far East and Germany, the burden of proof really lies on those who assert the complete independence of the European invention."
Another question of controversy is whether typography was an independent invention or merely a combination of existing technology. As Theodore de Vitry remarked, some scholars believe that 'typography was not an original invention, that it was nothing more than a new application of old theories and methods of impression'. According to this view, engraving can be traced back to the Egyptian seals, printing with ink to Roman hand stamps, and the combination of movable letters to the suggestions by Cicero and St Jerome. Gutenberg, therefore, was not the first to print on paper, for printed matter, in the form of playing cards, prints of pictures and printed books, was a merchantable commodity before he was born.

If typography was not an original invention, then the question arose whether existing techniques were derived from the East or the West. A British collector and antiquarian, John Bagford (1659–1716), wrote in 'An Essay on the Invention of Printing':

The general notion of most Authors is, that we had the hint [of printing] from the Chinese; but I am not in the least inclined to be of that opinion, for at that time of day we had no knowledge of them. I think we might more probably take it from the Ancient Romans, their Medals, Seals, and the Marks or Names at the bottom of their sacrificial Pots.

Although this author and some others attributed the existing techniques, including the use of seals, ink, and other materials and facilities, to the root of Western culture and not to the Chinese, it is the reverse that is true, as discussed in detail in the Introduction of this study. All the basic elements prerequisite to printing were available both in the West and in China, but the combination of them led to the early appearance of printing in Chinese culture and not in the West.

After discussing various factors leading to the invention of printing in Europe, Douglas McMurtrie, a modern authority on the history of printing, argues that the Europeans may have learned the idea of printing, though not the processes, from the Orient, but 'an idea is not an invention'. This statement is certainly debatable. Since an invention always involves both novelty and practice, processes carried out without a novel idea cannot qualify as an invention. The materials and facilities for European typography, including the ink, metal, and the press, may be somewhat different from those used in the Orient, but they constitute only an improvement of an already existing idea and procedures to suit different circumstances. If the basic principle of printing is to obtain multiple copies of a positive impression with ink on paper from a mirror image, this very idea suggests an invention.

Based on this principle, block printing is the ancestor of all printing processes, no matter whether wood or metal; block or movable; or plane, intaglio, or in relief. If the technical differences of typography from block printing justify its consideration

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* Cf De Vitry (1), pp. 90, 97–8.

* This article was originally published in the *Philological Transactions of the Royal Society*, vol. 25, 1796–7, and reprinted by the Committee on Invention of Printing, Chicago Club of Printing House Craftsmen, Chicago, Illinik, 1945. Douglas McMurtrie says in the Introduction Note that critics considered him not a scholar and 'quite incorrect' in what he wrote in this topic.

* See above, pp. 317, also G. R. Miller (1).


(i) Migration of Paper and Printing Eastwards and Southwards

Among the many neighbours of ancient China, some formed close ties with Chinese civilisation while others did not. To the north and west, the Mongols, Turks, Manchus, and Tibetans, although their histories were intertwined with that of China through wars and conquests, did not assimilate Chinese culture until they took up residence on Chinese territory. To the east and southwest, on the other hand, the Koreans, Japanese, and Vietnamese were clearly identified with the Chinese cultural outlook from very early times. They borrowed the Chinese writing system, followed Confucian thought, modelled their political and social institutions after those of China, and adopted Chinese forms of art and material life. While Japan maintained an independent political relationship with China, both Korea and Vietnam were under Chinese rule or acknowledge the suzerainty of China for prolonged periods. In one way or another, these three nations, and perhaps also Liu-Chin, became parts of the domain of Chinese culture, which is the basic element of East Asian civilisation.

(ii) Inception of Paper and Printing in Korea

Korea not only was the earliest nation to borrow many things Chinese for her own, but also formed a cultural bridge between China and Japan before they made
direct contact in the 7th century. How early paper and papermaking methods were introduced to Korea is uncertain, but geographical proximity suggests that these dates must have been very early. Since the northern part of Korea, including Lolang, was under Chinese control from the 1st to the 3rd century, paper began to be popular and spread beyond the Chinese border in both the northwest and southeast. From the latter half of the 4th century, Chinese Buddhist missions were sent to Korea, and in the 6th century Korean monks and students were in the Thang capital, Ch’ang-an, while more Chinese monks, scholars, artisans, and painters went to Korea. Since the crafts of making brushes, ink, and paper were learned by all foreign students in China, and papermaking was said to have been introduced to Japan in +570 by the Korean monk Darjingshi in Japanese: Donjo, 1297:1.19; the manufacture of paper in Korea must have been no later than this date, and perhaps began as early as the 6th century.

Korean papermakers used raw materials, tools, and techniques similar to those used by the Chinese. The materials included hemp, ratten, mulberry, bamboo, rice straw, seaweed, and especially paper mulberry (dark in Korean), which has been one of the major materials for papermaking in East Asia. The preparation of the pulp by pounding fibres of paper mulberry bark, boiling, sun-bleaching, and adding mucilaginous liquid was the same as is described in Chinese records. Moreover, the mould was made either of bamboo or a Korean grass (Moxanthus gnp.), with Chinese methods of construction for the frame, cover, and the two deckle sticks. After examining several hundred Korean papers from the 1st century onward, Dard Hunter said that the ‘laid lines’ run the narrow way and the ‘chain lines’, often narrowly spaced and irregular, run the length of the mould. Every sheet of Korean paper carries this marked characteristic.

Some specimen of the earliest Korean paper survive. A piece of glossy white paper made of hemp fibres is reported to have been discovered recently in a site of the Koguryo era (+37–668) in North Korea, and from the Thang dynasty, Korean paper, known as Chi-Lin-ch’i (paper from the Silla Kingdom), was an item of tribute to China, and its fine quality received high praise from Chinese artists and literati. It was described as thick, strong, whitish, and glossy, and was especially good for calligraphy and painting. Korean papers were also used for mounting scrolls and rubbings. A coarser and more durable kind called teng phi chiub

(8) (leather-like paper) was used for making raincoats and curtains, and for mounting book bindings. A number of such sheets pressed together and oiled were used as floor mats, and a single sheet was used in place of glass for windows. Another kind was large and durable enough to make a tent of several sheets joined together, and a thick and absorbent sort was used by Manchus to make shrouds. As the Ming author Sung Ying-Hsing said: ‘It is not known what the “white hammered paper” (Pai-ch’i ch’i) of Korea is made of.’ But more recent research makes it seem likely to have been made of paper mulberry bark by repeatedly pounding the long fibres into a fine pulp: this was a unique feature of Korean paper.

The Korean government attended to papermaking with great concern. A special Office of Papermaking (Chojo) was established in the capital early in the 1st century, and staffed with nearly 200 papermakers, mould makers, carpenters, and other labourers under the charge of three supervisors. Hundreds of local papermakers were also commissioned in various provinces, and when large-scale printing projects occurred the government coordinated the paper supply from all over the country. This happened, for instance, in 1434, when 300,000 sheets were required for printing the general history of China, T’o Ch’’u Thang Chon, and paper mulberry bark was collected from the provinces in 1437 when the Tripitaka was printed. With the development of printing and the increasing need of foreign trade, paper supplies became inadequate and various measures had to be taken by the government. The import of Japanese materials and technology was increased, productive papermakers were rewarded, and a search for new raw materials was encouraged. But this was not a unique instance, for government sponsorship of papermaking paralleled their encouragement of the development of printing and publishing throughout many centuries of Korean history.

Korea also made good ink for writing and printing. Inkmakers were employed in government offices from very early times, and as early as the Thang dynasty, Korean ink was among the annual tributes to China. It was produced by mixing the lampblack of old pine with a special glue obtained from the anlers of the tailed deer (Cercus davidiennis) and is described as being as black as varnish. For printing with metal type, a high-quality oil was added to make it less heavy and greasy than European inks, and both Korean paper and ink were cherished by Chinese poets, as well as by people of other countries.

Among many landmarks in the history of printing, the Koreans have at least three distinctions: possession of the world’s earliest known printed specimen,
survival of a complete set of wood blocks which is perhaps the largest and oldest of its kind in the world; and, finally, being the first to use metal type, so antedating Europe by some two hundred years. The earliest extant printing was discovered in Korea in 1966 in a stone stupa at Pulguk-sa in Kyongju, the capital of the Silla Kingdom (+668–935), and provides material evidence that printing existed around +700. This specimen is composed of separate pieces of thick paper mulberry paper joined together in a continuous scroll about 20 feet long and 2½ inches wide, and mounted on a wooden roller lacquered at each end. The printing was done from a series of twelve woodblocks, each about 20 or 21 inches long and 2½ inches wide, with eight characters in each vertical line. The text is a Buddhist sutra in Chinese, Wu Kuang Ching Kuang Tu Tho Lo Ni Ching1 (Fig. 110), translated from the Sanskrit Rasitvayamalaavivoddhahadhavidhavanayah by the monk Mi-Tho-Hisen2 of Tokhara between +660 and +704, while he was living in the Thang capital Chiang-an. This period corresponds closely with the reign of Empress Wu, who ruled China from +684 to +704, and during whose period on the throne about a dozen new forms of characters were created in Chinese. At least four of these, including chung3 for proof, shen4 for beginning, shin5 for to confer, and shu6 for earth, occur in the printed text, the last appearing four times. What is more, the calligraphic style and its variations are very similar to those of the Thang manuscripts from Tunhuang, and it is generally believed that, after completion of the translation in +704, this specimen must have been printed in Thang China and brought to Korea for ceremonial use no later than +751, when the stupa was built.

Korean printing was promoted, as in Vietnam and Japan, first by the spread of Buddhism and, later, by the adoption of the civil service examination system modelled after the Chinese pattern. As early as in the +10th century, several printed sets of the Tripitaka were obtained from Sung China and the Liao or Kitani Kingdom, and with these examples as a basis, the first Tripitaka Koreana, in some 5924 chapters, was printed between +1011 and +1082, in fulfilment of a vow for expulsion of the Kitani invaders. In addition, a supplement, consisting of about 8000 chapters of writing by Korean, Kitani, and Sung authors, was compiled and printed by the prince monk Gitan7 before he died in +1101. This edition was later destroyed when the Mongols invaded the country in 1232, and a new edition in 6971 chapters was printed from +1237 to +1254. This is the famous Eighty Thousand Tripitaka (Fig. 1206), so called because it consisted of 81,258 blocks of magnolia

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1. See Goodrich (33), pp. 329ff.1 Leukard (41); Yi Honggi (50), ch. 8, see also discussion on pp. 175ff above.
2. Cf. Y. I. Chung, Ching Kuang Tu Tho Lo Ni Ching (1959), ch. 3, pp. 14ff, with new forms of characters found in some 4700 Turfan manuscripts of the same period, see ibid. (51), p. 14ff, sample characters are given in Nghiem Tuan and Louis Saule (1959), pp. 214f.
3. See examples given by Yi Honggi (47), ch. 8, pp. 21ff.
4. See Goodrich (33), pp. 329ff. Some Korean scholars deny that this text was printed in Korea, on the ground that the ink or paper mulberry was used and the new forms of characters and certain calligraphic variations also appear in a few manuscripts now kept in Japan; see Yi Honggi (47), ch. 8. These arguments seem compelling, inasmuch as paper mulberry had been used in China since the +3rd century, and there is no evidence that these peculiar forms of characters were also used in Korea. Furthermore, there is no other record indicating that printing was done in Korea until some 300 years later; see also discussion on pp. 175ff above.
5. Cf. Lee Ho (5000 FW), ch. 30, p. 114, which notes a copy of the Tripitaka was requested by Korea in +669 and printed by China two years later; and that no fewer than six or seven copies were obtained from the Kitani Kingdom; see Carter (2), pp. 85, 92; Chang Hio-Min (50), pp. 165.
6. The theory that the first Korean Tripitaka was cut in the middle of the +9th century is invalid, since an ambiguous statement based on a dream in the source is generally considered a forgery; see Chang (3), pp. 104–5.
books to Korea for reasons of national security, but this only encouraged further development of printing by the Koreans, so that they could become self-sufficient in supplying the books they needed, especially the Confucian classics, Neo-Confucian writings, and medical works. In the +12th century, Koryŏ began extensive printing after the establishment in 1101 of a printing office in the National Academy, which took over the wood blocks from the imperial library, with the result that a member of the Chinese mission to Korea, Hsü Ch'ung-t'ang (1201–1253), could report a government collection at Koryŏ which numbered several tens of thousands.

Under the Mongol domination from around 1270, further political and cultural ties were established between Korea and China, and also with Central Asia. In 1290 the Yuan court sent a group of craftsmen to repair the Haein-sa wood blocks, and one copy of the Koryŏ Tripitaka was presented to the Yuan court in 1298, and another to Mongolia in +1314. Furthermore, to honour the Yuan emperor, in 1312 a Korean king who had married a Mongol princess ordered fifty copies of the Tripitaka to be printed for distribution to various temples. Again, a large collection of over 10,000 Chinese books was brought to Korea in 1314, this in addition to some 4000 volumes donated by the Yuan court. All these activities were related to Buddhism in one way or another, for extensive printing of secular works was not begun until the overthrow of the Koryŏ dynasty at the end of the 14th century. Then the establishment of the Yi dynasty (+1392–1910) brought political stability, social reforms, and cultural vitality to Korea; it promoted Confucianism over Buddhism, adopted the civil service examination system, established the national university, and created an alphabetic script, known as Han-gu, as its national form of writing. It was under this new regime also that the demand for more books promoted the wide application of metal type for printing.

Although the first extant book printed from metal type was made at the beginning of the 15th century, a contemporary record indicates that a copy of the ancient and modern ritual code, Kojun Sungjung Yeaeguk, was printed about +1294 on Kanghwa Island, off the west coast of Korea from 'cast characters' (in Korean: chu chara). However, at least two wooden movable-type editions, a work on the laws

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Footnotes:

2. No evidence of printing blocks from China, in addition to some 5000 sheets of printed books and manuscripts.
and statutes of the Ming dynasty and a biography of the founding fathers of the Yi dynasty were printed in 1395 and 1397 respectively. Then, in 1409, a new Bureau of Type Casting (Chuja-se) was added to the Office of Publications (Sôjôkwon). From this time until the middle of the 15th century, no fewer than thirty fonts are known to have been produced, ranging from 60,000 to as many as 300,000 characters each, making a total of two or three million. Except for one made of zinc in 1496 and two of iron in 1468 and 1721, the metal fonts were bronze; there were also six or seven fonts of wooden type.

All the early fonts were given names from the sexagenary cycle, for example kimi-sa for type cast in 1403 (Fig. 1205); later ones were named after calligraphers, the titles of books to be printed, or places where the fonts were stored. The most elegant calligraphy among all these fonts was that of one made in 1434 and modelled after the style of the famous Chinese calligrapher Madame Wei of the + 2nd century (Fig. 1209). All the type was of Chinese characters except a few for the Korean alphabetic scripts (Fig. 1210). Most of the early fonts have now been lost through fire or war, or melted down for recasting, the great loss occurring during the Japanese invasion of 1592-9, when many technicians and their fonts were taken back to Japan which was starting its own movable-type printing. The use of wood and iron instead of bronze in Korea was necessitated by the resulting shortage of copper and the interruption of trade after the war.

The Office of Publications played a major role in printing and book manufacture, especially with movable type. We know, too, from the number of craftsmen employed, that there was a division of labour in this office during the 15th century. The employees included over 100 foundrymen, typecasters, type cutters, wood carvers, typesetters, printers, papermakers, proofreaders, and inspectors, and a very strict system of punishments and rewards was maintained for quality control. Careful work was rewarded with bonuses or official titles; negligence was punished by thirty blows per error. For this reason, Korean
editions have been known for careful collation and physical qualities compared with those printed in Ming China.

It appears that the use of movable-type printing in Korea was influenced by three major factors, all more or less related to Chinese practice. One was the idea of movable type. This was unquestionably inspired in Korea by the method described in Chinese records, for in the preface to a movable-type edition of Po Shih Wen Chi,3 printed in Korea in +1489, the Korean scholar Kim Jongsiki4 said explicitly that the movable type method was begun by Shen Kua and brought to perfection by Yang Wei-Chung.5 Although he was mistaken in identifying Shen Kua as the inventor, his acknowledgement of its Chinese origin is clear. How it arrived in Korea is not certain, but it may have been brought back by the prince monk Gitan, who travelled to China and resided in Hangchow in the latter part of the +11th century, at the time and in the very place of P Sheng’s invention.6 He could, therefore, have been informed by his contemporaries in China, or through reading Shen Kua’s description, which certainly influenced the adoption of movable type by Korean printers. If so, the use of movable type in Korea must have begun earlier than the generally accepted date of 1374.

Second, the technology of type-casting was apparently adapted from that of casting coins. As described by the Korean scholar Sŏng Hyǒn7 (+1439-1504), the character was first cut in beech wood which was then pressed into soft clay to make a mould. Molten bronze was poured into the mould to form the type, which was then polished to its final shape.8 In 1502, the Chinese method of casting coins, known as ‘dram-casting’ (ka cha), was introduced to Korea,9 and later it was said that the ‘clean and even’ inscriptions cast by the Chinese method were the indispensable prerequisite for making a clear type.10

Third, the demand by the educated elite for more books during the 12th century could only be solved by the use of movable-type printing. With the establishment of the Bureau of Type Casting, printing developed with such vigour that no book on any subject was not available in print and the Office of Publications was engaged every day in printing rare books which were brought from China.11 Some scholars have suggested that because of the shortage of suitable wood for block carving, copper alloys and other metals were used for casting type.12 However, this does not seem to have been the major reason, since tens of thousands of woodblocks were carved for printing the Tripitaka on several occasions. The high quality of the

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6 Sŏhn (1), p. 99, considers that the ka cha method coincides with what was described by Sŏng Hyǒn and not with what the commentator on the Hsia Shih referred to as ‘smelting by the use of a fan’.
7 Cf. Sŏhn Pow-Key (1), p. 100.
8 See citations from Korean sources in Chang Hio Min (2), p. 185.
9 For example, Sŏhn Pow-Key (1), p. 98.
what is more, the court used hundreds of thousands of sheets of paper at a time copying Buddhist sutras, thus creating another major demand.\footnote{Cf. Jisaku Bunke (7), pp. 39-42, 51-2, 203, 315-20.}

The administrative code of +701 provided for a government office to make paper, and after the capital had been moved to Kyoto, the Kamayain,\footnote{Cf. Jisaku Bunke (7), pp. 195-96.} a paper mill, was set up between +806 and 810 to supply the needs of the court.\footnote{Cf. Jisaku Bunke (7), p. 49.} Today the Shōsōin still preserves many examples of old paper (Fig. 1212), and early government documents there often contain references to paper; indeed, from +767 to 780 some 293 different varieties of paper were referred to.\footnote{Cf. Jisaku Bunke (7), p. 49.} At this time the government used many different papermaking materials. Most early Japanese papers were made of hemp, two types of paper mulberry: kozo\footnote{Kozo} (Broussonetia papyrifera, Vent.) and kajūnoki\footnote{Kajunoki} (Broussonetia kazinoki, Sieb.), and gamp\footnote{Gamp} (Wilsodendria

\footnote{Cf. Jisaku Bunke (7), p. 49.}
The early papers in Japan were produced by the same method as that used in China, called *tamezakib* (accumulation papermaking), which is still in use for some papers. Another method, *nagashizakib* (discharge papermaking), that was developed in the 8th or 9th century, has been used to produce most Japanese paper in later times. Its distinctiveness lies both in the technique of the vatman and in the addition of a vegetable mucilage to the fibres in the vat. The mucilage performs a number of functions, such as causing the fibres to be evenly distributed in the solution, with the result that the paper is stronger, firmer, and glossier. With the *tamezaki* method the vatman dips the mould into the vat, lifts up the pulp solution, and then allows the water to drain, but with the *nagashizakib* method the vatman shakes the mould with the pulp both forward and backward from right to left, which serves to align the fibres regularly, and rather than allowing the excess water to drain naturally, he shakes the mould so as to remove the water. One of the early books on papermaking, *Kamisuki chiboku*, published in 1598, gives the step-by-step procedures with illustrations (Fig. 121).6

During the Heian period the most famous papers were those manufactured in the Kamaya in Kyoto, but towards the end of the period these papers were sometimes made of recycled materials, and they declined in quality. Danishi, a high-quality paper made of paper mulberry (kozo), originally manufactured in Nihoku and later at other places also, replaced the Kamaya paper at court. During the Heian period paper production spread throughout the country as indicated by the fact that at the beginning of the 4th century leaves of paper were exacted from forty-two provinces. From the Kamakura period (1192–1333) a variety of papers came into prominence, some limited to particular places and others produced more widely, and paper became a popular as well as an aristocratic commodity. During the 13th century paper guilds and paper markets arose, and later the paper trade increased with economic growth and the elimination of tariffs. The scale of this trade may be gauged from the fact that in the 17th century the association of paper merchants in Osaka consisted of about 70 wholesalers, 155 or 156 brokers, and about 500 retailers, and indeed, paper was one of the most important trade commodities in both Osaka and Tokyo. Unfortunately, despite its high quality, aesthetic appeal, and popularity, Japanese handmade paper has gone into a long

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