Newspapers, Tenki Washi Tsukai,2 or Comprehensive Collection of Handmade Japanese Paper, published in five large boxed sections in 1973-4 with text in Japanese and English, consists of samples of raw materials and some 1000 specimens of various kinds of handmade paper. The set by the Takes Co., Kami,4 or Handmade Paper of the World, provides articles in Japanese and English and samples of handmade papers from twenty-three countries throughout the world, including twenty-nine samples from China.6

Together with paper, there is also a great deal of information for the study of Chinese ink, which has been closely associated with the writing brush, the inkstone, and with paper, these comprising the ‘four treasures of the scholar’s studio’. The literary records include general treatises and history of ink, biographies of inkmakers, recipes and procedures for inking, albums of ink designs, catalogues of ink dealers and connoisseurs, collections of works on ink, and modern studies in different languages. Besides these, artifacts, ink traces on ancient relics and on paintings and in calligraphy are also available for examination to help determine the composition of old ink.

The first general treatise on ink, as on paper, is included in the 17th-century work, Wen Fang Su Chu, which also contains sections on other writing materials. Since then, numerous monographs have been written exclusively on ink and inking, and these include at least five or six titles written by Sung and Yuan authors between 1100 and 1350, and nearly two dozen such works by Ming and Ching authors between 1400 and 1900. Many interesting but not easily accessible writings can be found in the two comprehensive collections on ink: the Shih Liu Chi Mo Shou,7 which contains sixteen titles mostly by Ming-Ching writers, compiled by Wu Chiang-Shou8 in 1922; and the Shi Yuan Mo Taiju,9 which includes twelve works by authors from the Sung to the Republican period, published by Thao Hsiang10 between 1927 and 1929.

Interest in ink has continued into modern times, especially in its new techniques and the artistic appreciation of its use. This is exemplified in two Japanese monographs, one by Watanabe Tadaichi11 (2) on colour pigment, crayon, and inking which has been translated into Chinese, and another by Togari Shoichi12 (2) on the connoisseurship of Chinese, Korean, and Japanese inks. A more recent treatise in Chinese by Mu Hsiao-Tien13 (2) contains an historical account of inking in She-hsien, Anhui, which has been the centre for manufacturing the four scholar’s ‘treasures for writing’ for many centuries. A catalogue of four modern ink collections in Peking was published as late as 1936.14

The earlier studies in Western languages of Chinese ink include those by Stanislas Julien & Champion (a) in 1853 and J. Gschewitsch (1) and Maurice

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Jametel (1), who translated into German in 1858 and French in 1896 respectively the Chinese work on inking Ma Fa Chi Tiao15 by Shen Chi-Sun of the 14th century. The most comprehensive translation of Chinese sources on ink was made by Herbert Franke (28), who in 1953 published in German the full text of four monographs on Chinese ink by Sung and Yuan authors, in addition to parts on ink in seventeen other works and verses on ink by six poets from before the 16th century.16 A few monographs on Chinese chemical arts, printing, and writing also contain some information on ink.17 Other accounts include those by Berthold Laufer, who contributed five chapters on Chinese, Japanese, Central Asian, and Indian ink in F. B. Wilborg (1); by Wang Chi-Chen (1) on the appreciation of Chinese ink, based on the fine examples at the Metropolitan Museum of Art in New York City; and by van Gulik (9, 11) on the connoisseurship of Chinese ink. Finally, a recent study by John Winter (1) on ink traces in old Chinese paintings, which uses scanning electron microscopy, represents a new approach to the study of this subject.

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(4) Sources for the Study of Chinese Printing

Information on Chinese printing is available primarily from artifacts, printed materials, descriptions in book catalogues, and other literary records. The artifacts include printing blocks and movable types made of various materials from different periods and various kinds of tools for carving and printing. These objects provide us with details about some of the technical aspects of the craft which are not normally described in literary sources. Only a few such specimens pre-date the Ming period. One wooden block of an Amida Buddhist sutra said to have been made in the Northern Sung period is kept in an American collection.18 Two other pieces with human figures, perhaps of the same period, are now kept in the Chinese Historical Museum, Peking (see Fig. 105).19 Over 1200 wooden blocks from the 16th century are in the Thien I Ko5 Library in Ningpo.20 Many more of the Ching and Republican periods are kept in various libraries and publishing houses in Peking, Nanking, Hangchow, Szechwan, and other places.21 Bronze blocks for printing

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* See description under Anon. (252) in Bibliography B.
* Cf. Takes Eiichi (2).
* See Yeh Kuang-Chih (2).
* 云岩乾天לק
* 言前
* 十六家墨法
* 刘宾权
* 唐德谨
* 朱德元
* 余道亮心
* 傅业天

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* Also, the Thien King Kao Wu, a 17th-century work on Chinese technology, includes a chapter on vermilion and ink, see: Sun & Sun (1), ch. 16, pp. 237-88.
* For example, such works as Stanislas Julien & P. Champion (2), Carter (1), Li Chih-Lo-Phung (1), and T. H. Tien (2) include a chapter on ink.
* The block is said to have been found in Chi-hs in Hopei. It was formerly in a Japanese private collection and is now kept in the Spencer Collection of the New York Public Library; see a picture and short description in the Yosh Koda Eiga Shi (Tokyo, 1942).
* Both blocks are said to have belonged to Northern Sung and also found in Chi-hs. One is a carved picture of a well-dressed woman in the Tang style with two hands clasped. The other is a picture of three women in a line under a curtain with inscriptions on both sides. The one on the left says: 'Good luck for raising silkworms by three women; the one on the right says: 'Good luck for collecting a thousand pounds and a hundred sowers.' Apparently this is a picture for worshipping patrons of silk culture; see WATI, 1911 (no. 32), pp. 70-1.
* See list of titles for the blocks in Feng Chen-Chih (1), ch. 5, Appendix 1.
clay moulds of the early 19th century found recently in Hui-Chou, Anhui, which are now kept in the Institute of the History of Natural Science, Academia Sinica, in Peking. A small number of wooden types of later date are also on hand. Aside from these, types made of clay, wood, or bronze are virtually no longer extant. Failing also to survive are the tools for carving, brushing, and printing used in former times, but some of those used by modern craftsmen are believed to be similar.

While few blocks and movable types survive, printed books and single sheets are available for study. These range in date from the earliest use of block printing to the early years of this century, when traditional block printing was still in use. Specimens of woodblock printing from the 8th to the 10th century are extant in and outside China. Some 2000 printed works of the Sung, colour printing from the Yuan, and about thirty titles printed with bronze type from the late Ming period are known to be kept in public and private collections throughout the world. In North America alone, more than one-half of the four million volumes of Chinese books in various library collections are believed to be traditionally printed and bound editions, including over 100,000 volumes printed in the Sung, Yuan, and Ming periods.

Besides these original editions, many such books have been reprinted in facsimile using woodcut, lithography, offset, or a photo-duplication process. The facsimiles provide near-exact copies of the originals, except for paper and ink, and permit study of their calligraphy, format, and other details. There are also several compilations of selected Chinese books of rare editions in facsimile, such as the woodcut specimen by Yang Shou-Ch’ing (1), the photolithographic Sung, Chin, and Yuan samples by Ch’i-i Chhi-Chia (2), and Ming editions by Phan Chheng-P’’ (3) and Ku Thiang-Lung (4). Also notable in this regard is the Cheng-Chiu Pan Ku T’u Lu (5), an illustrated catalogue compiled by the Peking Library, which includes.

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* The earliest known sample extant is a copper plate of c. 1024-1026 (see Fig. 158).  
* Britton (1), pp. 99 ff; the block is now kept in the collection of the American Numismatic Society, New York.  
* Ch’i-i Carter (1), pp. 218-219. According to Dr. Goudsward, Miss Pollock and her lawyer informed him several years after her husband’s death that the Urga type could no longer be found.  
* A collection of several boxes of early bronze movable type from Korea is said to have been preserved in the Museum of Natural History in New York, see Animal History (Sept. 1961), p. 74.
samples of all kinds of Chinese printing by woodblock, movable type, and multi-colour processes from different periods. Where original works no longer survive, much information about them can be gathered from bibliographical descriptions in catalogues of public and private collections, in which dates, names of printers, and descriptions of formats are sometimes given. Unlike the great deal of information that can be found for paper, there is very little on printing in Chinese literature. Almost nothing about such technical matters as how blocks were carved or used in printing is mentioned in any pre-modern documents, except for occasional records made by foreign observers. Descriptions of printed editions or publishing records are often found in standard histories, histories of institutions, individual literary collections, miscellaneous writings, local histories and sometimes clan records, but they are generally very scattered and sketchy.

Two early systematic studies of Chinese printing of great influence may be mentioned here. One is the Shu Lin Ching Hua by Ye Hte-Hui, first published in 1911 and with a supplement in 1925. It consists of an initial chapter on the moral obligations of printing, a discussion of bibliographical terms, and topical remarks on manuscripts, printing, publishers and dealers arranged under broad chronological groupings through the Ching period. Another is the Ching-Kuo Tung Pan Yian Lue Khuo by Sun Yu-Hsiu, published under the pseudonym Lii An in 1916. This is a collection of quotations from various sources grouped under the broad topics of printing, paper, and bookbinding, without critical comments. Besides these two early monographs, information on printing is generally included in works on historical bibliography, or pan pan hui hui, such as Chih Wu Wan Li and Chihang Pi-Te (7), Ciben Kuo-Ching (7), and Mao Chih-Hsiang (7) (r) and in general histories of books or publishing such as Liu Kuo-Chin (7, 2, g). Concerning the origin and development of Chinese printing, major contributions were made by Hsiang T’ang (7), Wang Kuo-Wei (7, 7), and Li Shu-Hua (7, 7) for the Thang and Five Dynasties, and by Chang Hsueh-Min (7, 7) for the Sung and Ching periods. Chang Pi-Te (7, 7), and others on various subjects from the Sung to the Ching period. As for the artistic and technical aspects of Chinese printing, numerous studies were made on movable type by Chang Hsueh-Min (7, 7), on woodcuts and book illustrations by Cheng Chen-Tsoh (7), Kuo Wei-Chin (7), and Wang Po-Min (7), and on the evolution of the physical book and book-binding by Ma Heng (7), Li Wen-Chhi (7), and Li Yao-Nan (7). These represent the best of modern Chinese scholarship in the field.

Japanese sources for the study of Chinese printing are more numerous and important than those in any other language besides Chinese. Japan’s long tradition of collecting and reprinting books in Chinese has left us with many useful descriptive catalogues of Chinese books, facsimiles of old and rare Chinese editions, and reprints of Chinese woodcuts and book illustrations. Lists of Chinese books can be traced back to the 4th century, and when large-scale importation of Chinese Buddhist and Confucian classics commenced. During the 17th and 18th centuries, several catalogues of Chinese and Japanese movable type editions were compiled. However, systematic studies of Japanese and Chinese printing were not launched until the beginning of the 20th century, when contributions were made by such scholars as Shigama Kano (7, 7) in 1905, Asakura Kamezono (7, 7) in 1909, and Nakayama Kyoshibi (7, 7) in 1917. These studies laid the foundation for further investigations in both China and Japan. Shigama’s critical notes on old Chinese manuscripts and printing include sections on Chinese bookbinding and printing which are considered to be pioneer studies in the field, despite some shortcomings. The work by Asakura is the first systematic study of Japanese printing and that of Nakayama is still the most comprehensive treatise in the field, with rather full coverage of China and Japan and a brief account of Korea, although it is out of date in some respects. The most important contributions of Japanese scholars to our knowledge of Chinese and Japanese printing made in the last fifty years or so are those of two eminent scholar-bibliographers, Kawaue Kazuma (7, 5) and Nagasawa Kibyou (7, 7). Their studies are both intensive and extensive. While Kawaue’s contributions are primarily in the areas of Japanese books and printing, especially movable type and Goshinhan printing, Nagasawa’s over two dozen monographs and numerous articles cover more aspects of the Chinese book, bibliography, and printing. His works on the history of Japanese and Chinese printing, published in 1952, and an illustrated history of Japanese and Chinese printing, published in 1976, are both resourceful and critical. His studies of Sung and Yuan block cutters have suggested a new method for the identification of old printing.

Not many Korean sources on Chinese printing are to be found, but numerous artifacts and several secondary sources are available for the study of Korean printing, especially movable-type printing. One of the modern authorities on early movable type in Korea is Kim Won-Yong (7), which deals with the historical
development of movable type and includes a table of different fonts and a summary in English. There are also collections of samples of Korean movable type printing. One by McGovern (1) includes twenty-two reproductions of original Chinese or facsimile pages, and another by Sohn Pow-Key (2) with text in Korean and English also includes samples of facsimile pages. Both of these were made by using deeply etched photo-engravings taken from original pages. Several kinds of handmade papers and water-based ink were used with metal plates in imitation of the original process. These specimens look and feel more authentic than facsimiles made by offset processes or photographic duplication.

Western scholarship on Chinese printing has focused on two major aspects of this subject, namely its beginnings and its spread westwards. Writings on these subjects by early European travellers and missionaries before the end of the 18th century will be discussed later. Detailed discussions of scholarly researches on Chinese printing began only in the 19th century. These include works on the history of printing by Isaiah Thomas (1) in 1810, Robert Curzon (2) in 1838, and Theodore De Vinne (3) in 1876; remarks on Chinese printing in general histories of China by John F. Davis (4) in 1856 and S. Wells Williams (5) in 1858, and particularly the monograph on the history of Chinese printing by Stanislas Julien (6) in 1847. Julien’s studies of Chinese block printing and movable type, despite their incorporation of quotations from inaccurate Chinese sources, laid down the foundation for the later studies by Western scholars.

With the discoveries of manuscripts and printed specimens in Tun-huang, Central Asia, and Africa around the turn of the 20th century, studies by such scholars as Hermann Hülle (7) in 1923, Thomas F. Carter (8) in 1925, Berthold Laufer (9) in 1931, and Paul Pelliot (10), whose notes were published posthumously in 1933, have added substantially to our knowledge of the subject. Especially significant was the work by Carter, which was revised by L. Carrington Goodrich in 1935. It synthesized all previous researches and further elucidated the subject in the context of Chinese-Western contacts. This work, which has had a significant influence on Chinese and Western scholarship on printing, remains a classic in the field. More than three quarters of a century following its first appearance, no work of comparable magnitude on Chinese printing has been published. In recent years, major contributions have primarily been made by Goodrich (11–12) and by his critical studies of new discoveries and his revision of Carter’s work; Richard Rudolph (13) in his translation and study of the Wu Ying Tien manual on movable type of the Ching dynasty; and K. T. Wu (14, 8, 10) in his works on the development of Chinese printing from the Sung to the modern period. In the fields of woodcuts and colour printing, several monographs have been produced by Max Loehr (1), Josef Hejduk (2), and especially Jan Tschichold (3–7) whose reproductions of a series of Chinese colour prints using modern techniques provide a new source for appreciation and study of this Chinese art.

Despite the contributions to the study of Chinese paper and printing of this band of international scholars whose specialties cover various disciplines, many gaps in this field are still open. Systematic investigations of their social, economic, and intellectual roles and influences in Chinese history are lacking; comparative studies of their origins in and impact on China and the West are especially needed, while certain questions have never been raised for discussion. For example, why were paper and printing invented early in China and not in other civilizations of the world? What effects did these inventions have on changes in Chinese society compared with those in the West?

In studies of Chinese paper, local histories of manufacture and distribution are scarce and the origins of the various uses to which they have been put have not been fully and systematically covered. For example, paper clothing and furnishing have never been mentioned in Western literature. Wallpaper and paper-folding are said to have originated in China, but further evidence is needed to substantiate this claim. On the other hand, watermarks are said to have been invented in the West in the 15th century and marbled paper in the 16th, but both artifacts and documentary sources indicate that they were made in China several centuries earlier. Also, hundreds of trade-names of paper derived from materials, methods, quality, locality, and makers or designers, for the most part incomprehensible to laymen, need to be collected and explained.

In previous studies of Chinese printing, emphasis has been placed on its origin and spread westwards, but its development and contributions have either been oversimplified or underestimated. Many technical and artistic aspects that have been ignored, especially the procedures involved in preparing and printing from both blocks and movable types, need detailed step-by-step descriptions accompanied with illustrations. Also needed are analytical studies of calligraphy, formats, materials, and methods used in printing that could lead to the establishment of new criteria for dating and authenticating old prints. Although an attempt has been made here to fill some of these gaps in the present study, many questions are still waiting for satisfactory answers.

(8) NATURE AND EVOLUTION OF PAPER

(1) PRE-PAPER MATERIALS FOR WRITING

Before paper was used for writing at the beginning of the Christian era, the Chinese selected a great variety of hard and soft materials for documents, historical records, for personal communication. These included such animal products as bones, shells, ivory, and silk; minerals such as bronze, iron, gold, silver, pewter,
inscriptions, such perishable materials as bamboo, wood, and silk were used extensively for books, documents, and other writings of daily life. The former group of materials was intended for vertical communication across generations and the latter, primarily, for communication among contemporaries. Bone and shell are the oldest surviving materials on which the earliest known Chinese writings were inscribed. The bone primarily used was the ox scapula, which provides a wide, smooth surface for writing. The shells were the plastron and carapace of the tortoise (Fig. 1054). They were used for divination by the royal house of the Shang dynasty, and oracular messages were usually recorded on them after divination was performed. The inscribed materials so far discovered cover about 250 years from the early to the late 12th century. The Shou court continued to use bones and shells for divination, but oracular inscriptions were, in general, written separately on bamboo and silk, except perhaps for the early Chou period. The inscriptions recorded such natural phenomena as eclipses, rain, wind, snow, or clear skies; forecasts of happenings during the coming evening, day, ten-day week, or year; premonitions for forthcoming travel, hunting, fishing, and military campaigns; human fortunes such as birth, illness, or death, and the evidence of dreams, as well as sacrifices to ancestors, deities, and other spiritual beings. The inscriptions were carved with a stylus, but a few were written with brush and ink made of lampblack or cinnabar. The carved grooves were sometimes illuminated with pigments or inlaid with turquoise for decoration. Since very few pieces of literature transmitted from the Shang dynasty survive today, these inscriptions are the most important documents for the study of the history and institutions of ancient China.

Inscriptions were also made on various kinds of metal objects, ceramics, and clay materials. The most important and extensive inscriptions are found on bronze dating from the Shang to the Han period. These inscribed bronzes include sacrificial vessels, musical instruments, military weapons, standards of measurement, mirrors, coins, seals, and other articles, but most of the inscriptions of historical significance were cast on ritual vessels, especially those of the Chou dynasty. These contain from a few to as many as some 300 characters each; the latter equaling in length the chapter in an ancient book. Bronze inscriptions of

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Footnotes:
1. For detailed discussion of pre-paper materials, see Tien (2).
2. A total of over 100,000 pieces were found in private diggings and official excavations from 1939 to 1957; diggings have continued since 1952, and some 300 pieces were found near Anyang in 1973.
3. Individual pieces dated to the Chou were found in Huai-yuan, Swatow, in 1926, Peking in 1937, and a score of pieces from the early Chou period were found in Chinese (Huai, Sian, 1925, 1976, 8 WWJK, 1975, no. 10, pp. 38–45, ph. 4–7; also Wen Wu Kai Shu Xuan Si Shu Shih Hua, 1949–1979, pp. 4–16).
4. For further discussion, see Cred (1), pp. 11, 12; Tien (2), pp. 18–19; Reinhartz (1), pp. 134–135.
5. Liu Ti-Chih, Hsueh-Chung-Fu-Chen Wu Shih Ku (1953) contains about 5,500 bronze inscriptions reproduced from rubbings; numerous inscribed objects have been found since that publication.
6. The most significant find in recent years includes a series of 64 bronze bells inscribed with some 600 characters on music, found in Sui-ho, Hopei, and two Chao-Kuo bronzes containing the longest inscriptions of that period, each inscribed with 540 characters and another with 468 characters from a tomb dated to 300 B.C., of the State of Chou-chun in modern P'ing-chun, Hopei, found in 1954–56 WWJK, 1954, no. 4, pp. 147–157.
the Western Chou include long narrative compositions such as records of military campaigns, covenants, treaties, appointments, rewards, ceremonial events, and other political and social affairs (Fig. 1055). Inscriptions from the later Chou are in general shorter, more apt to follow a formula, occasionally composed in rhyme, and written in ornamental style, sometimes in 'bird script'.

Mirror inscriptions appear on the inner or outer part of circular designs on the backs. The earlier ones, from the Warring States and Han periods, include expressions of human desires for spiritual and material satisfactions, greetings and good wishes, political messages, and allusions to various folk beliefs. Inscriptions of the Sui and Tang periods are mostly formulae consisting of a few characters. Numerical inscriptions appear on almost all early and late metal coins, which were shaped like stones or knives or were round with a square hole in the centre. These inscriptions are primarily the names of places of manufacture and numerals indicating denominations of the coins. Ancient seals were of various materials, including cast metal. They were used to stamp inscriptions on small lumps of clay for authentication before they were used to make impressions on silk and paper. Pottery, bricks, and tiles also bear inscriptions, while symbols and numerals are found on Neolithic pottery, with later vessels being inscribed with names of makers or owners, official titles, place and date of manufacture, and, sometimes, imperial edicts (Fig. 1056). Inscriptions on bricks consist mostly of dates, names, and

Fig. 1055. Bronze lacquer vessel of the Western Chou dynasty with cast inscription on inner surface, c. 11th century (diameter 27 cm.), British Museum.

Fig. 1056. Inscriptions on pottery vessels. (a) A measuring vessel with imperial decree of the First Emperor of China, dated 221 B.C., ordering standardization of weights and measures. (b) Rubbing from a vessel with imperial edict of Wang Mang, 184.
miscellaneous records. Decorative inscriptions or pictures on roof tiles include lucky formulas, and the names of palaces, temples, mausoleums, granaries, or other public or private buildings, to commemorate their construction.

Inscriptions on bronze and stone are the two major categories of material for the study of Chinese epigraphy and archaeology. While bronze inscriptions may be more ancient, those on stone are more numerous, longer, and more readily accessible. This is because stone is more abundant, more permanent, and makes possible a wider surface for inscriptions, with the result that, from the +2nd or +3rd century onwards, stone was extensively used not only for monumental and commemorative inscriptions but also as a permanent material for preserving all the canonical literature of China.

Among the earliest inscribed stones of historical significance are the ten drum-shaped boulders known as the Stone Drums (shí fā), dated variously from the 8th to 4th century. The inscriptions were written in verse and concerned hunting and fishing expeditions on certain memorable occasions; they originally comprised some 700 characters. In addition, during the reign of the First Emperor of Ch’in, between -219 and -211, seven monumental stone tablets were inscribed to praise the achievements of his administration. All these earlier stones were in the form of crudely truncated rocks, but a more refined style of flat stele, known as a pei, was used since the Han dynasty. From that time, numerous tablets have been inscribed to commemorate historical occasions, to preserve the memory of individuals, and to standardise sacred texts in correct and permanent form.

One of the most gigantic projects for the preservation of standard texts was the engraving on stone of the entire collection of Confucian classics. No fewer than seven different editions were inscribed from the late +2nd until the end of the 18th century. The first edition, of seven classics in over 200,000 characters, was carved on both sides of forty-six steles, from +175 to +180 (Fig. 1057). The last, including all the Thirteen Classics, was made from 1791 to 1799 under the Ch’ing dynasty. Engravings of Buddhist canons on stone came later than the second century, but achieved much greater scope and size. The Buddhists selected stone because it was the best material for preservation of their sacred texts; as one devotee said: ‘Silk will decay, bamboo is not permanent, metal seems hardly eternal, and skin and paper are easily destroyed.’ A grotto library, started in +605 and continued until +1061, consisted of 105 Buddhist sūtras of over four million words carved on more than 7000 steles. This collection is still preserved in the Mountain of Stone Sutras.

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* For inscriptions on seals, sealing clay, and pottery vessels, see T’ien (4), pp. 54 ff.; also below, pp. 176 ff.

* Dating of some stones is controversial; see Kuo Mei-jie (14); Ma Heng (15); Thang Lin (16); Akamatsu Kiyoshi (17); and a summary in T’ien (18), pp. 73 ff.

* The original stones are kept in Peking, but only about 500 characters are extant.

* C. S. Sih Ch’i (1963) PW, ch. 5, pp. 148-176; ch. 6, p. 308.

* See Chung Kuo-Kan (2); Ma Heng (3); Wang Kuo-Wei (4); and a summary in T’ien (5), pp. 73 ff.

* Cited in Shen To Chin Sūtra (1797 ed.), ch. 10, p. 118.

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* For further discussion, see T’ien (7), pp. 90 ff., 175-4.

* 石經山
The succession of various book materials in China may be divided into three periodic bamboo and wood from the earliest times to the +3rd or +4th century; silk from the +7th or +6th to the +5th or +6th century; and paper from the +1st century to the present. Thus the use of bamboo and silk overlapped by about 1000 years, those of silk and of paper by 500 years, and those of bamboo and paper by 300 years. The old-fashioned materials were replaced by new ones only gradually, and not until after the +3rd century were bamboo and wood entirely superseded by paper.

Since the end of the 19th century, no fewer than 48,000 tablets of bamboo and wood have been unearthed from various locations in China. They cover a span of almost 1000 years of Chinese history. The important discovery sites include those in Hanan, Hupei, Honan, and Shantung in the central plain of China; Tsinhuang, Chu-yen, Chih-chihian, and Wu-wei in the northwest; and the ruins of Loulan, Khotan, and Turlu in modern Sinkiang. Among these, Chiang-sha, Hsin-yang, and Yün-meng yielded the oldest bamboo tablets, dating back to the Warring States and Ch'in period; Chu-yen supplied the largest quantity and the most important core of wooden tablets of the Ch'in dynasty; and all documents from Loulan belong to the Ch'in dynasty. These tablets include official documents, private letters, calendars, lexicons for beginners, laws and statutes, medical prescriptions, literary texts, and miscellaneous records. The most important finds in recent years include a group of 390 wooden tablets, including seven chapters of the I L I or Book of Rituals (Fig. 1058), recovered from a Later Han tomb at Wu-wei, Kansa in 1955; over 4400 bamboo tablets on military classics from a Western Han tomb at Lin-i, Shantung, in 1972; 400 bamboo tablets on taxation and economic matters from a Western Han tomb at Tchiang-ling, Hupei, in 1973; 600 bamboo tablets of funerary inventories from Western Han tombs at Ma-Wang-Tui, Chiang-sha, Hunan, in 1973; 1100 bamboo tablets of legal documents of the Ch'in state from Yün-meng, Hupei; and some 20,000 wooden tablets dated from 1119 to +19, from Chu-yen, Kensa, in 1972 to 76. Among the most interesting items found in Chu-yen are some seventy-five complete or nearly complete documents on connected tablets strung together on two or three lines of hemp threads, and in the original format.

The preparation of tablets involved several steps. The bamboo stem was first cut into cylinders of a certain length and then split into tablets of a certain width. After the external green skin was scraped off, the tablets were dried over a fire to prevent any quick decay. Writing was carried out on the outside surface and sometimes on the inner surface of the stem as well. Wood, on the other hand, was cut into large

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* See Ma Heng (1), pp. 201 to 2; Tiern (2), p. 61.
* These include over 10,000 pieces found from 1953 to 1955, and nearly 39,000 from 1953 to 1957. See list of finds from ancient times to +575 in RWTH, 1958, no. 1, pp. 44.
* See a checklist in RWTH, 1958, no. 1, p. 44; Lowe (14), pp. 101 f.
* See report in RWTH, 1958, no. 1, p. 7, pl. II, illus. 35.

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Fig. 1058. Partial text of I L I, or Book of Rituals, on wooden tablets of the Later Han period found at Wu-wei, Kansa province in 1955. Spread out on the left and rolled up at right, each tablet ranges from 34 cm. to 38 cm. long and 1 cm. wide and consists of 60 to 80 characters. From Wucius Han Chiu, 1964.
slabs which were split into pieces of various sizes, and the surfaces smoothed for use as documents. Most of the wooden tablets are of pine, willow, poplar, and Chinese tamarisk, all noted for whiteness, light weight, fine texture, and absorbency. Old tablets could be re-used after the writing on them had been removed with a book knife, which was also used to erase errors. Bamboo tablets were narrow strips from eight inches to two feet four inches long, used for classics, literary compositions, and ceremonial documents. The length of wooden tablets was fixed at from five inches to two feet; they were used primarily for official documents, personal correspondence, and short messages. The tablets are almost invariably narrow, in most cases not more than an inch wide. A single bamboo tablet was called chien and a wooden one tu. Several tablets bound together with cords to form a physical unit were called ike. Writing of a certain length which formed a literary unit comparable to a chapter was called phien. Square or rectangular wooden pieces, called fang or pan, were sometimes made with a wider surface to accommodate more than one line of characters, or for maps and illustrations.

Characters were usually written with brush and lampblack ink, on one side, but in some cases on both sides. Each column of a tablet contains from a few to as many as eighty characters, but in general the average number is about thirty characters. The vertical arrangement of Chinese writing since very ancient times is believed to have been influenced by the vertical position in which the tablet was held, the grain of the bamboo or wood, and the soft brush which wrote more easily in a downward direction. Interestingly, modern studies indicate that vertical lines can be read faster than horizontal ones. The habit of a right-handed person, holding a narrow tablet in his left hand and writing on it with a brush in his right hand, would be to lay the finished tablet to his left, near at first and successively farther to the left as later tablets were finished. This might have resulted in the right-to-left direction of modern Chinese writing and reading.

As we have seen, silk was first used for writing, along with bamboo, no later than the 6th or 7th century, and continued in use after the 3rd or 4th century, after paper had become popular as a writing material. Yet it could have been used much earlier, since silk cloth, brush, and ink were available as early as Shang. Silk continued in use for documents as late as the Tang, being valued for its softness, light weight, durability, and absorbency. The term cha pu, “bamboo and silk,” was used extensively in ancient literature, to refer to written documents. Since silk was much more expensive than bamboo, but had a wider surface, it was used only where bamboo or wood did not suit the special purpose. We know that silk was employed for the final edition of a book, while bamboo tablets served for drafts. Silk was used in particular for books on divination and occultism, for illustrations appended to books of tablets, for maps, for inscriptions for sacrifice to spirits and ancestors, for recording the sayings of kings for transmission to posterity, and for commemoration of meritorious achievements of great statesmen and military heroes.

Although writing on silk is frequently mentioned in ancient literature, few specimens survive today. Until recently, only remnants of silk materials bearing long or short messages had been discovered in several sites in China and in central Asia. Two of the earliest specimens on silk came from Chihang-sha, one bearing an illustrated text and the other a drawing. The silk document consists of two paragraphs of text in about 200 characters. Each is upside down in relation to the other, and they are surrounded by strange animal and human figures in colour on all four sides of the piece. The other piece is a painting depicting a woman with warps at the centre with a strange animal over her head. Both of these seem to indicate the mysterious nature of the Chih culture. The most significant find in recent archaeological excavations is a collection of ancient books copied on silk fabric with ink, in the small seal and li styles of calligraphy. These include more than a dozen pre-Chin works such as the Lao Tzu (Canon of the Virtue of the Tao) (Fig. 1059), the Chien Kao Tuo (Intuitions of the Warning States), and the I Ching (Book of Changes), several other titles, and some old maps. The total number of characters comes to over 120,000, including many parts of ancient books which have been lost long and are not included in the extant editions. This is the first major cache of silk documents to be discovered.

Silk used for writing is generally called iu, a plain white fabric without design or dye. Its varieties included the chuan, a thin and gauze-like material used especially for painting and calligraphy; the chen, a fine and closely woven textile made of double threads and yellowish in colour; and the ing, a thicker and darker fabric.

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* It is said that texts by Liu Hsin (6) to (9) were first written on bamboo and then copied on silk when completed. Cited in T'ou, ch. 466. p. 24.
* Three 4th-century maps on silk were recently found in the Western Han tombs at Ma-Wang-Tui, Chihang-sha.
* See citations on the special usefulness of silk for documents in Tien (2), p. 685; also Tien (2), p. 685-6; Chien-Tien Ho (4), p. 296-7; also p. 181-2.

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* 織
* 館
* 原
* 通
* 穗
* 茲
probably made from wild silk. When they were used for books and writing, they could be cut as needed and rolled up as a physical unit called chán (roll). This system was inherited almost entirely by paper when it was substituted for silk for writing. As the historical record says, 'silk was expensive and bamboo heavy; and a light but less expensive material called chīth (paper) was finally introduced as an ideal medium for writing.

(2) DEFINITION AND NATURE OF PAPER

Paper, as we have seen, is a matted or felted sheet of fibres formed on a fine screen from a water suspension. When the water drains away, the remaining mat of fibres must be removed from the screen and dried. This definition applies to what 'paper' is today and also to what it was yesterday. Sheets of paper were made from disintegrated fibre upon a flat mould before the time of Christ and paper is still formed in this fashion; the only difference lying in the construction of the moulds and the treatment of the fibre. Thus the fundamental principle of papermaking involves two basic factors, the fibres and the mould. These two principal elements were clearly given in a definition of paper contained in an old Chinese lexicon compiled during the time when paper was beginning to be popularly used in the early years of the Christian era.

In the Shuo Wen Chieh Tsü (Analytical Dictionary of Characters), compiled by Hsi Shen around + 100, the word chīth for paper is defined as 'a mat of refuse fibres' (tai i chán jîh). Here the key words are tai (refuse fibres) and chán (mat). According to the definitions given in the same ancient lexicon and its commentaries by later scholars, tai means fibrous remnants obtained from rags or from boiling cocoons, and chán meant a mat made of interwoven rushes which was used for covering. Thus the fibres and the water-draining mat have been the two basic factors in papermaking since ancient times. The definition given in the old Chinese dictionary, which mentions these two basic elements, corresponds very well with what is described today.

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* Hsu Han Shu (ISSN/TWC), ch. 168, p. 5a.
* See definitions given in American Paper and Pulp Association, The Dictionary of Paper (1946), p. 196; 3rd ed. (1965), p. 282. Reprinting (1), p. 1; (2), p. 18. Since materials for more recent papermaking include all kinds of fibres, the new edition of The Dictionary of Paper has changed its definition of paper from 'a sheet of vegetable fiber' to 'all kinds of natural or treated sheets of fiber' (usually vegetable but sometimes mineral, animal or synthetic). We shall follow this new definition in our discussion below.
* See Defo Honoré (1), p. 10.
* See collected commentaries on the definition in Tong Fu Pao (3), Shuo Wen Chieh Tzu Fu Lin, p. 599.
* The character chán is written with the grass radical in the earlier editions of the Shuo Wen Chieh Tzu (see reprint of a Bangkok edition in the SPTFE), but this was changed by later commentators to the bamboo radical. The bamboo plan the water radials in later editions, to suit their own interpretations; see Chien Tsin-Hsin (5), p. 127, u. II.
* This translation of the definition of chán is based upon the form with the grass radical in the earlier editions, see forms reproduced in Tong Fu Pao (3), p. 596; supplement, p. 896.
It has been suggested that the manufacture of paper in China originated from the process of pounding and stirring rags in water, after which the wadded fibres were collected on a mat. The treatment of rags in water was probably an old practice in China many centuries before the Christian era, for ancient literature frequently testifies to the washing, pounding, or stirring of rags in water by women. Wu Yiyan (—6th to —5th century), a political refugee who fled from the Chou to the Wu state, is said to have stopped the Lai River where a woman who fed him with food was pounding rags (shu bai). The Zhang Te (—3rd century) says that a family of the Sung state had a recipe for salting chapped hands and from generation to generation his family made their living by pounding and stirring rags in water (pham phi huong). Sau-ma Chien also says that Han Hai (—165), Lord of Hoai-yang, was fishing outside of the city where he witnessed many women washing rags in the Huai River; one of them worked continuously for several tens of days. Apparently, the treatment of refuse silk, the re-use of old fibres in quilted clothes, and the washing of rags of hemp and linen required such constant activities with fabrics in water. It is very likely that an accidental placing and drying of refuse fibres on a mat suggested the idea of making a thin sheet of paper.

Before papermaking, there were other ways of turning fibres into a sheet. It could be done by matting and pressing into a felt, by spinning and weaving into a textile, and by soaking and beating into a bark cloth or tapa. The art of felting is one of the oldest methods of making fabrics and earlier than that of weaving and spinning; felt being used for clothing and covering by the inhabitants of northern and middle Asia from very ancient times. How early felt was used in China is uncertain, but the Chou Li (—3rd century or earlier) records that felt (chan) was made of animal hair by the officials of the Chou court in charge of leather (Chang Phip). No evidence is known to suggest that the invention of papermaking in China was influenced by the method of felt making, but the techniques of both are quite similar.

There is a close relationship between textiles and paper. Not only were they made of the same kinds of raw materials at the beginning of their manufacture, but they also had a similarity of physical forms and properties. Even their uses were often interchangeable. Textiles were sometimes employed for writing and painting, while paper was substituted for textiles for clothing and furnishing. Indeed, it is generally known that silk cloth had long been used for writing before it was replaced by a thin sheet made of refuse fibres, which were obtained either from the remnants from boiling silkworm cocoons or by pounding rags in water. When the sources of raw materials expanded to include such new fibres as those of raw hemp and tree bark, it opened a new page of papermaking with fresh vegetable fibres for unlimited production.

While the use of raw hemp was likely to have evolved from that of rags of hemp or linen, the adoption of tree bark for papermaking could have been inspired by the prior use of bark cloth made from the paper mulberry. This tree has been cultivated extensively in China and the bark cloth is known to have been made and used for clothing in south China from very ancient times. The bark of paper mulberry, after it was beaten into a thin sheet, had also been used for clothing, covering, and hangings by primitive peoples in the temperate and tropical zones throughout the world. It has been suggested that the cradle of bark cloth was in China, and that manufacture spread perhaps from the southern part of China by way of the islands in the South China Sea eastward to the farthest regions of Pacific and Central America, and westward through the Indian Ocean to reach Central Africa, covering almost all areas along the equator.

The moistened tissue of the bark can be expanded to as much as ten times its original size, and several pieces can be joined together by gluing the overlapped edges into a very large sheet. Although it is as white, soft, and flexible as paper, its manufacture is much more laborious and time-consuming. Only one to three sheets could be made by one worker per day, while 2000 sheets of paper could be made by the same labour. It is very likely that the native people in south China, who were familiar with the making of bark cloth, made use of the same fibres for papermaking. When the beating process was replaced by maceration and felting, it was natural that the same material could be turned into a thin sheet of paper.

Besides sheets manufactured from fibres, there were other natural materials such as animal skins, leaves, and papyrus which were all used as a medium on which to write, though none were ever used in China. In Europe and the Middle East from the 2nd century onwards until after the arrival of paper, skins of sheep, goats, kids, calf and other animals were made into parchment. The most superior quality parchment, known as vellum, was especially prized for its fineness, whiteness and smoothness as a writing material. It was stronger than paper, but more expensive as the skins of some two hundred animals were needed to provide enough sheets for a single book.

Of all the materials that were used for writing, probably the earliest were leaves.

* See commentaries on the definition of shu by Ts‘ao Yu-Ts‘ao (—1536—1603) and others in T‘ung Fu-P‘an (1). p. 3707; also discussion by Lo An-r‘en (2), pp. 210—211; Chien P‘en (3), pp. 177—178; and Chien T‘ao-Hsien (4), pp. 1—10.
* Ts‘ao O-lin Shu (SPTK), ch. 1, p. 36.
* Chang Tao (SPTK), ch. 1, p. 158.
* Shih Chi (SCTT), ch. 30, p. 14.
* CE, Chou Li (SPKT), ch. 9, p. 594. The Chinese never utilized wood for fabrics in early times, and felt-making could have been learned by the Chinese from their northern neighbours.

* Paper mulberry was grown in the Yellow River valley from Shang times and the use of bark cloth for personal attire dates to the Chou period in the 6th—5th centuries; see discussion of papermaking with paper mulberry (pp. 357—358) and use of bark paper for clothing and hangings (pp. 356—357 below).
* CE, Chou Li (SPKT), ch. 9, p. 594.
* Playfair says the first certain writings were on palm leaves which were followed by tree bark; see Dinger (3), p. 49.
Palm leaves, which are thick, narrow, and sometimes as long as three feet, were used in India and other nations in South and Southeast Asia. They were incised by a stylus and rubbed with black ink or other pigments. The strips of leaves were then bound by stringing on to cords. Papyrus was used in Egypt as early as the third millennium before Christ, and was made from the inner bark of the papyrus plant (Cyperus papyrus). The bark was split into pieces which were placed crosswise in several layers with an adhesive between them, and then pressed and dried into a thin sheet which was polished for writing. Scholars of both East and West have sometimes taken it for granted that paper and papyrus were of the same nature; they have confused them as identical, and so have questioned the Chinese origin of papermaking. This confusion resulted partly from the derivation of the word paper, paper, or paper from papyrus and partly from ignorance about the nature of paper itself. Papyrus is made by lamination of natural plants, while paper is manufactured from fibres whose properties have been changed by maceration or disintegration.

(3) The Beginnings of Paper in the Han
A number of specimens of paper from the 2nd century onwards have recently been discovered in various parts of China, a witness to the origin and development of paper in the Han dynasty. The oldest paper extant today is probably the specimen discovered in 1957 in Pa-chhiao, near Sian in Shensi province, in a tomb dated no later than the period of Wu Ti (r. -140 to -87) of the Former Han dynasty. The specimens, including one large piece about 10 cm. square (Fig. 1060a) and many fragments found under three bronze mirrors, are said to be light yellow, thick and uneven, coarse and crude, with some textile impressions on the surface. On one of the specimens some loops of fibres are visible, and on another a small remnant of thin, two-ply hemp cord. These seem to indicate that this paper was made of rags or other previously used materials made of hemp, probably dried on a mat woven like a piece of fabric.

The existence of paper of vegetable fibres in the Former Han may be supported by several other old specimens from archaeological discoveries. One fragment, 10 by 4 cm., dated on circumstantial evidence to about -49, was found in the

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2 Joseph Edkins (18), pp. 67-8, questioned the validity of the Chinese invention; the Chinese historian Chien Po-Tsiang (7), p. 521, says that this paper entered in Athens and Alexandria 400 years earlier than in China; and the novel Egyptian papyrus (1), p. 39, n. 2, considered that the Chinese invention was influenced by acquaintance with Egyptian papyrus; see discussion on the Western origin of paper in Tsien (9), pp. 40-2.
3 This discovery was first reported in the NWTE, 1957, no. 7, pp. 28-9, n. 11; thus, the specimens were said to have consisted of fibres similar to silk, but later microscopic study revealed it was made of hemp; see Phan Chi-Hung (3), pp. 45-7.
4 Further discussion during the Former Han period of possibly discovered paper specimens have been raised and discussed by paper specialists in China; see Wang Chih-Hua & Li Yu-Hsueh (1), Cheng Chih-Chien & Yang Yu-Ran (3), and Phan Chi-Hung (12).

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32. Paper and Printing

Fig. 1060a. Oldest paper specimen of the Former Han period. (a) A large piece of hemp paper, 10 x 10 cm., dated -2nd century from Pa-Chhiao, Shensi province. (b) Fibres of the above enlarged 4 times. (c) Paper fragment from Chin-Kuan, Chi-Yen, 21 x 15 cm., r. -2nd century. (d) Paper specimen from Fung-Fung, Shensi, 6.8 x 7.2 cm., r. -1st century. Courtesy of the Institute of the History of Science, Academia Sinica, Peking.

ruins of a watchtower in Lopnor by a member of the Mission of the Northwestern Expedition of China in 1934. Two larger pieces dated of the second half of the -1st century, were found in 1974 at a watchtower in Chin-kuan, near Chi-yen (Fig. 1060c). A few other pieces, mostly fragments attached to a lacquer utensil with coins of the Hsin Chih period (r. 73 to 49), were found in 1978 in an

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1 See Huang Yen-Pi (1), p. 188, pl. 25, fig. 19. It is reported that this piece was destroyed during the war in the 1930's.
2 See a report in NWTE, 1937, no. 1, pp. 1-14, pl. 1-9, fig. 1-42; on the same and other nearby sites some 20,000 wooden tablets of the same period were discovered.

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1 金國
underground vault in Chung-yen village, Fu-feng, Shensi province, \( \text{Figs. 106b, d; 106} \). All these pieces are of later date but are similar in quality to the Chinese paper, being made of hemp fibres, yellowish, thick, coarse, and uneven with loops of fibre visible on the surface. They provide some evidence of the beginning of the art, especially those discovered in the more accurately dated sites located in the central plain of China.

Besides the archaeological evidence, paper before Tshai Lun's time is mentioned in several places in the ancient literature. In one story laid in -93, an imperial guard advises a prince to cover his nose with a piece of chih (paper). Another relates that in a murder case in -12 the poisonous 'medicine' was wrapped in hu-thi,\(^5\) which means a thin piece of chih of red colour, according to the commentator Ying Shao\(^4\) (c. 1400-206). The official history records that, in the reorganisation of the Imperial Secretariat by Emperor Kuang-Wu, the Assistant of the Rights (Ya Ch'eng)\(^5\) was responsible for the seals and cords of the office, and for paper, brush, and ink.\(^6\) It also says that a scholar was summoned to the court in +96 to give instruction to twenty students, who were each given a copy of the classic written on tablets and chih.\(^6\) In +102, an imperial consort, née Teng, who was a lover of literature and instrumental in Tshai Lun's presumed invention, is said to have asked that chih be sent as tribute from various countries.\(^6\) All these stories recorded in official histories and other documents indicate that chih existed before +105, the traditional date of the invention of paper by Tshai Lun who, since his own time, has been credited as the inventor or sponsor of the methods of papermaking.

Tshai Lun\(^7\) (d. +171), tza Ching-Chung, a native of Kuei-yang (modern Leiyang, Hunan), was a eunuch who served at the imperial court in or before +75, and was promoted in +89 to Shang Fang Su, an office in charge of manufacture of instruments and weapons. He was described as a man of talent and learning, loyal and careful. His biography in the standard history says:

In ancient times writings and inscriptions were generally made on tablets of bamboo or on pieces of silk called chih. But silk being costly and bamboo heavy, they were not convenient to use. Tshai Lun then initiated the idea of making paper from the bark of trees, remnants of hemp, rags of cloth, and fishing nets. He submitted the proposal to the emperor in the first year of Yuan-Hsing (+105) and received praise for his ability. From this time, paper has been in use everywhere and is universally called 'the paper of Marquis Tshai'.

Similar records are included in the T'ung Kuan Han Ch'u,\(^8\) an official history written by a group of contemporary historians from +25 to +189,\(^9\) and in other sources,

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\(^4\) See two reports in W.F.T., 1979, no. 9, pp. 17-7.


\(^6\) Chien Shao Su (ESS/77), ch. 57, p. 76.

\(^7\) Hua Hsu (ESS/77), ch. 56, p. 75 ch. Hsiao Byong-P'ing (2), p. 55.

\(^8\) Hua Hsu (ESS/77), ch. 56, p. 75.


\(^a\) A brief version appears in the reconstructed text of the T'ung Kuan Han Ch'u (T'ung T'ung Kuan Han Ch'u), ch. 50, p. 176; see also in T'ang Ch'en (2), p. 176. The reconstructed text is slightly different from that cited in Pi Feng, Su Chien and Chu Hsi Ch'i (2).

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Concerning Tshai Lun's paper.\(^*\) All provide information about the kinds of raw materials used, the date of the official presentation, and the life of Tshai Lun himself.

The existence of paper before Tshai Lun does not necessarily contradict the story of his contribution as recorded in the official history. It is possible that he was an innovator who used new raw materials in papermaking. Indeed, the term tao used in his biography can be read as 'to initiate the idea' of introducing new materials, especially tree bark (su-thi) and hemp ends (hu-thi), which was not a second-hand material previously used for other purposes. As to the rags of cloth (pho-pu) and fish nets (yi-ang), they may still have been mentioned as common or officially approved materials for papermaking, even if they had been so used before. In any case, rags and second-hand materials were probably used first, but their supply was limited compared with that of fresh fibres from trees or other plants, which made possible the large-scale production of paper. It is also suggested that the use of tree bark for papermaking by Tshai Lun may have been influenced by the bark cloth culture which existed before the manufacture of paper by a process of felting.

Several recent archaeological discoveries support the literary evidence of the official records. A specimen of writing contemporary with Tshai Lun was found under the ruins of an ancient watchtower in Tsu-kho-tai near Chii-yen (Khara-khoto) by a party from the Academia Sinica in 1942. This remnant of paper, which is said to be made of vegetable fibre, is coarse and thick, with no clear screen marks, but it bears about two dozen readable characters in a šě style. Fig. 105f is said to be similar to that appearing on a piece of pottery dated +156.\(^b\) From historical evidence, this piece of paper can be dated between +105 and +110, when the watchtower was abandoned by Chinese defenders because of the rebellion of the Hu-ch'ing tribe. This was the first find and the earliest sample of paper with writing on it. Other specimens of the Later Han period found in recent years include a plain piece found near a mummy in a tomb in Min-feng.\(^c\)Sinkiang, in 1955, and several pieces with some writing, not all of which is legible, from a tomb in Han-chia-pho.\(^d\) Wuwei, Kansu province, in 1927. Some of the latter specimens are said to have been nailed, in three layers, with wooden strips on both sides of an ox cart when they were discovered. Made of hemp, they have been proved to be more advanced than other finds, since some of them are white, much thinner than

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\(^*\) See T'ang Pa (1931), Fs Fu Chih, quoted in T'ung T'ang, ch. 6, p. 52.

\(^b\) See Ling Shao-Ming (2), pp. 32-4; also discussion of tao on pp. 114-5, below.

\(^c\) Lao Kan (2), pp. 460-5. A bundle of wooden tablets dated +156 to +158 was discovered at this site, which was explored earlier by the Sino-British Expedition in 1930, see Bergmann (2), pp. 115-6.

\(^d\) See Pan Chih-Hsin (3), p. 47.

\(^e\) Lao Kan, who found this paper, dated it around +188 (his article in 1948, but later changed his dating to +190 or +191 on historical grounds; see Chien Shao Su (ESS/77), ch. 56, p. 71).

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\(^1\) See a report in W.F.T., 1966, no. 6; the finding of a paper specimen at this site is mentioned in Pan (3), p. 95.
the Pa-chhiao paper, and can be written on with brush and ink. It is the second find of paper specimens of the Han period with writing.

A few artisans of the Han period are known to have contributed to the improvement in the quality of paper. Tso Po1 (+206), 128 Tzu-i,2 a man of Tung-lai in Shantung who lived at the end of the Han dynasty, is said to have made paper of "beautiful and lustrous appearance," which matched the excellence of ink and brushes manufactured by other great masters.3 Khung Tan,4 a legendary figure, is reputed to have lived in the Hoian-cheng area in the late Han period, and to have discovered the value of the bark of shan wood in making the high grade paper (hsien chih5) for painting and calligraphy.6 No other names of papermakers are recorded in early literature or on artifacts, but the methods of Chinese papermaking progressed with new materials and techniques at the advent of each new dynasty.

(4) The Progress of Papermaking from the Chin to the Thang Period

While the Han dynasty witnessed the beginning of papermaking, the period from Chin to Thang (4th to 10th century) was probably the most important time for discovery of new raw materials, further improvement in techniques, wider application, and the more widespread use of paper. Rattan, grown primarily in southeast China was introduced as a raw material, and marked a great step forward in papermaking in this period.

The use of local raw materials for papermaking was perhaps conditioned by the political and intellectual factors of the time, especially the isolation of Eastern Chin following the move of its capital from Loyang to Nanking, and by the increasing demand for paper for writing and other uses. Although it had been used for writing as early as the 1st century, it was only from this period that Chinese books on bamboo and wooden tablets were entirely replaced by paper. We know that one of the largest discoveries of bamboo books made in the 3rd century was transcribed on paper to be kept in the imperial library. The Chin bibliography recorded all books as rolls (chhien6) instead of tablets (tien7) as was done in earlier bibliographies.8 We have also found that from this time paper began to be made on a fine bamboo screen-mould, well sized, and treated with an insecticidal dye for permanence. It was made in many colours for stationery, cut into designs for embroideries and decorations, used to make rubbings from stone inscriptions, for documents and books, for painting and calligraphy, for visiting cards, and for such household articles as fans, umbrellas, lanterns, and kites; there were even sanitary and toilet papers.9

A great many paper fragments of Chin dynasty date, discovered in Central Asia since the turn of this century, illustrate the spread of paper outside the domain of the Chinese empire. Some of these, dated from +252 to 310, were found by Sven Hedin in the Loulan region in 1909.10 In the same region, Aurel Stein in 1914 found hundreds of paper fragments dated +263-80,11 and a collection of paper documents and letters written in Sogdian in about +312-13.12 Some paper manuscripts of this period were discovered in the region of Turfan and Kao-chiang by the Prussian Expedition of 1902-1413, and also by the Japanese Expedition of the Nii-Hongwan in 1902-13.14 A great many paper books, documents, and artifacts from the +4th to the +9th century have also been found in this area by the Chinese archaeological excavations in more recent years (Fig. 162).15

On the other hand, paper made in foreign lands may have been imported to China in the early Chin period. One source records that in +264 Ta Chihin16

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1 Wen-Feng Ssu Pha (TMCC), p. 53.
2 See Ma Hsiao-Thien (1), p. 4.
3 佐伯
4 竹田
5 今紙
6 今紙
7 今紙
8 今紙
9 今紙
10 今紙
11 今紙
12 今紙
13 今紙
14 今紙
15 今紙
16 今紙
17 今紙
18 今纸
presented 30,000 rolls of honey fragrance paper (mi hsiung chih) to the Chinese Emperor, who bestowed 10,000 rolls on Tu Yu1 (+222-84) for writing his commentary on the Confucian classics. Scholars question that this paper originated in Ta Chhin (the Roman Empire), but suppose that it was made in Indo-China of garo wood (Aquilaria agallocha), and brought to China by Alexandrian merchants in lieu of articles from their home. Another story relates that Emperor Wu (r. +265-90), bestowed upon Chang Hua2 (+292-300), for writing his Po Wu Chih (Record of the Investigation of Things), 10,000 pieces of intricate filament paper (chih hsi chih) sent as tribute from Nan-Yieh3 (modern Vietnam). Geographic proximity makes it likely that the craft of papermaking reached southern neighbors rather early, and paper made of local materials was brought to China as tribute to the Chinese emperor.

Political stability, economic prosperity, and official fostering of scholarship in the Thang dynasty, all encouraged the increasing production and further improve-

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1 See Na Fong Tien Mu Ching (DBFT), ch. 2, p. 6a, attributed to Hsi Hua (+165-308). A recent study exposes doubts of the authenticity of its author and dating and says that stories similar to that of the honey fragrance paper occur in two Thang works: see Mu Tho Lai (2), pp. 239-401; (1), pp. 199-202. Nevertheless, the importation of exotic papers from foreign lands in the 1st-7th century must not be dismissed.
2 Hirth (1), pp. 234-5.
3 This story appears in the 3rd-century work Ah Chi (DBFT), ch. 2, p. 7a, in authenticity has also been questioned; see Chang Te-Chin (1), p. 80.

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4 See Hsin Tong Shi (CBBT), ch. 41, pp. 18-22; Yen Mu-Chen Hsin Chih (TSBT), ch. 26, pp. 60-61, ch. 38, pp. 275-93.
5 See Chiu Tong Shi (CBBT), ch. 47, p. 494.
6 About 7000 rolls and 3000 fragments acquired by Aurul Sturz in 1907 are in the British Museum, London; more than 3000 rolls collected by Paul Pelliot are in the Bibliothèque Nationale, Paris, a few hundred rolls obtained by the Japanese expeditions in 1908-14 were kept in Eisei Komia's house near Kyoto and said to have been transferred to the Koryo Museum in Dairen, Liao-ning; about 10,000 rolls were removed in 1909 to the Imperial Library in Peking; over 10,000 rolls, mostly fragments, collected by Sergei F. Oldenburg in 1914 and 15, are in the Institute of the Peoples of Asia, Leningrad; and certain minor collections are scattered throughout the world, see Fujita Masa (1) and (2); So Ying-Hsi (4), pp. 75-82.
7 For a summary of the contents of the T'ung-huang rolls, see Fujita (2); So Ying-Hsi (4), pp. 25-68; for description of these documents see catalogues of various collections listed in T'ung (101, pp. 438-42.

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1 蜜香纸
2 杜煥
3 張登
4 許運志
5 倪成虎
6 崔自
7 印紙
injury from natural or artificial causes, and have remained in perfect condition.

The commonest papers in the Tunhuang collection were made of hemp and paper mulberry, with a few of ramie and mulberry. Although literary sources indicate that bamboo and rattan also were used at this time, these materials were not found in Tunhuang, probably because both bamboo and rattan were grown in southern China and not available in this border region. The papers of earlier periods, especially those made in the 5th and 6th centuries, are reported to be generally thin, of uncertain thickness, highly finished, well sized, and stained yellow or brownish. Those of later date, especially of the 10th century, show deteriorated quality. With rare exceptions, they are coarse, drab-coloured, and thick. The rolls are made from ten to as many as twenty-eight sheets of paper, pasted together to form a long scroll, the beginning of which was covered with a piece of thick sheet that was attached to a roller at the end. The individual sheets average about one foot wide by two feet long, while some rolls are as much as twenty-three feet long. The earliest sheets of paper were narrower, but the size gradually increased in the Sui and Tang dynasties. Sizes were variously uneven in the Five Dynasties period.

(5) Development of Papermaking from the Sung Dynasty

As the supply of rattan was gradually exhausted, the Sung dynasty made extensive use of bamboo for papermaking. During this dynasty, the major manufacturing centres included those in Kuei-chi and Shan-chi in modern Chekiang; Hsi-hsien, Hui-chou, and Chhi-chou in modern Anhui; Fu-chou in modern Chiangsi; and Chhsing and Kuei-ching in modern Szechuan, which had been a major centre for papermaking since the Thang. It was said that, in the 10th century, some of its skilful papermakers were recruited by Li Yu (+937–78), ruler of the Southern Thang, to go to Nanking to make the time-honoured paper bearing the name of his palace. After the fall of the Southern Thang, however, these craftsmen migrated to other cities in the lower Yangtze valley, where new centres for papermaking were developed to compete with those in Szechuan. Fei Chou (fl. +1251) said that papers manufactured in Anhui, Chiangsi, and Chekiang were sold for as much as three times the price of those made in Szechuan, but people liked the fine, thin sheets of the imported paper better than the heavy local product.

For the various needs of the government, the levy of tribute paper continued. It is recorded that the prefecture of Hsin-an (modern Hsi-hsien, Anhui) sent some 1,500,000 sheets of paper of seven varieties to the capital as tribute each year before

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* Some fifteen documents dated +948 to +991 in the British Museum, analysed by Clapperton (1), p. 36, are reported to be dominantly paper mulberry; thirty-two specimens dated +959 to +984 in the Peking collection are mostly of hemp; see Phan Chi-Hsung (2), p. 40. 1

* The average thickness of papers of early Thang is measured at .002–.005 inch, and of later Thang at .008–.012 inch; see Clapperton (1), p. 8. 2

* See an analytical study with tabulation in Phan Chi-Hsung (2), pp. 39–41. 3

* For the making of the Chien Hsin Thang paper for painting and calligraphy, see p. 59 below. 4

* See Chin Chu-Pin (22), p. 3. 5
In that year, the Emperor reduced the quota because sending extra large sheets of paper caused a heavy burden on the people. To supply its needs for paper, money, exchange certificates, and other uses, the government also established many large paper factories of its own. For the printing of paper money alone, several factories were operated in Hui-chou, Ch’eng-tu, Hangchow, and An-chi. In +1173, the Hangchow factory, for example, employed more than a thousand daily workers.6 Fei Chu said that in Ch’eng-tu there was a temple to Shih Lao where he was worshiped by several hundred families engaged in papermaking, all of whom resided in a village some five miles south of the city.8 Farmers attracted by the profits of papermaking were leaving their fields to take employment in paper mills because of the increasing demand for paper to be burned for spirit sacrifices, and for other uses.2

After printing became popular in the Sung, the need for large quantities of paper for making books further stimulated the development of the paper industry. Not only did the National Academy (Kuo Tzu Chien) in K’ai-feng and later in Hangchow engage in large-scale publishing, but many private families and trade agents in Ch’ing-tu, Hangchow, and Ch’ien-yang also engaged in printing and papermaking. Also popular in the Sung was the making of inked scribes from stone and bronze inscriptions, since interest in traditional archaeology was developing at this time. Indeed, scholars might possess as many as several thousand rolls of such scribes as treasures in their collections.6 To meet the special needs of painting and calligraphy, a kind of paper in extra large sheets, known as pho-chih,8 was specially made. Su I-chien (+1057–95) described the making of a sheet of paper fifty feet long in Hui-chou. The hold of a ship was used as a vat, and some fifty workers joined in lifting the screen-mould in time to the beating of a drum. This paper was dried over a big brazier instead of on a wall as usual, in order to make the sheet even. Many other varieties of paper were perfected in the Sung, including the famous Golden-Grain paper (Chin-chin ch’ien) for copying Buddhist sutras.1 Comments by the famous calligrapher Mi Fu (+1051–1107) indicate that papers made at this time were generally of excellent quality, white, smooth, and absorbent, most suitable for artistic purposes.8 It was during this time that paper was first named as one of the four treasures of a scholar’s studio (seen fang su pao), on which a famous treatise was written by Su I-chien in +1186.

The Mongols are credited with the further spread of paper and paper products westwards and elsewhere. Marco Polo was among the early European visitors to China who witnessed the wide circulation of paper money and the extravagant burning of paper effigies and replicas as offerings to the dead in the empire of Genghis Khan. An Arabian writer, Ahmed Sibah Eidin (+1245–1338), twice mentioned Chinese paper money in his book based on the eyewitness reports of others.6 Through intermediate steps, papermaking was introduced to Europe in the 13th century. Subsequent to this, Mongol conquests resulted in the first issues of paper money in Persia in the 13th century, and in Korea and Vietnam in the 14th century, while Japan also used paper money during this period. About this time, too, playing cards and other paper products were introduced to Europe, possibly through the Arab world.6

Throughout the Ming dynasty, papermaking continued to develop to meet the demands of the government and for general use in writing, publishing, art, and daily life. Bamboo became the predominant material in Ming papermaking, especially in the wide region bordering Chekiang, Chiangsi, and Fukien, where enormous bamboo groves were grown on mountains and along streams. A Ming gazetteer records that no fewer than thirty paper mills were operated in the town of Shih-deh (in Chihien-shan, Chiangsi), each with one or two thousand workers; a total of some fifty or sixty thousand people were engaged in the making of paper there in +1597.1 It was said that papermaking was the only profitable handicraft in Chihien-shan, whereas paper was traded to all parts of the country.

The various departments of the government requisitioned all kinds of paper for different purposes. The administrative code of the Ming dynasty records that 314,950 sheets of various kinds of paper were requisitioned by the Board of Works. Paper for legal use was acquired each season and reported at the end of each year. For the civil service examinations, 16,800 sheets of paper known as pang chih were requisitioned each year, with 1,400 additional sheets required if an intercalary moon occurred. A total of 1,200,000 sheets of such paper, specified to be 4 feet 4 inches long and 4 feet wide, were requisitioned from all provinces every ten years to be kept in storage for official use. If this were not sufficient, other kinds of paper, of irregular sizes, might be substituted. In +1576, the price of pang chih was 0.1 tael of silver per 100 sheets, and of tang chih paper was 0.04 tael per 100.

For printing exchange certificates for tea, salt, and other commodities, a total of 1,500,000 sheets was required to be sent in by various producing provinces. The quota set in +1393 included 380,000 sheets from Chihli, 250,000 from Chekiang, 200,000 from Chiangsi, 170,000 from Hunan and Hupei, 150,000 from Shensi, 100,000 each from Shansi and Pei-ching, 55,000 each from Shantung and Honan,

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2. Chien Chih Pu, p. 3.
4. Ch’eng Hsi (1077–?1157) stated that a thousand rolls of rubbings in his Ch’u Fa Lu, and Ch’ao Ming-ch’ing (+1068–1129) had some 2000 rolls in his collection, as noted in Li Chih-ch’ang’s preface to the Ch’in Shih 84.
7. See Phung Chih Yeh, also known as Shi Chih Shu, in MBS, vol. 6, pp. 305–307.
8. See Phung Chih Yeh, also known as Shi Chih Shu, in MBS, vol. 6, pp. 305–307.
and 40,000 from Fukien. When the papers were delivered they were carefully checked by the specifications and then deposited in storage until needed. In 1129, it was decreed that if the quality of paper did not meet the standards the same amount would be required for replacement. In 1424, the paper from Fukien did not meet the specifications, and the official responsible for requisitions was punished by the provincial judge.  

The first detailed description of the manufacturing process was made at the end of the Ming dynasty, when a chapter on papermaking was included in the Tien Kung K'ai Wu (The Exploitation of the Works of Nature), written around 1637 by Sung Ying-Hsin. This is probably one of the most important records of the technology of papermaking ever made. At about the same time as this book, several albums of ornamental stationery with multi-coloured designs were produced. Poems, notes, private correspondence, and certain contracts were all written on such elegantly and beautifully designed note papers. All these testify to the progress toward artistic and technical excellence of papermaking in the Ming dynasty.

Numerous books and documents written or printed on a great variety of paper in the Ming and Ch'ing dynasties survive today, as well as works of painting and calligraphy, and examples of articles made of various kinds of paper. For documentary use in the Manchu court, highly decorated fancy papers were specified in detail in the administrative code of the Ch'ing government. In 1634, when the first Manchu emperor came to the throne, it was ordered that stiff yellow paper in two layers should be used for the announcement of successful candidates in the palace examination for the chen-shih degree. Three grades of ornamental paper were used for imperial orders: golden dragon fragrant paper in four layers mixed with sandalwood sawdust; painted dragon paper with fragrant ink in three layers, and paper of dragon edge design in two layers printed with fragrant ink. For scrolls for bestowing honours to be inherited, 1000 rolls of paper were ordered in 1738. Three hundred of these were 50–40 feet long, 100 were 100 feet, and some were as long as 500 feet. The compilation and production under imperial auspices of the famous grand encyclopaedia T'ien Shu Chi Ch'eng in 5950 volumes, presented to the emperor in 1725, and of the huge collection of four branches of literature, Sin K'o Chih Hsuan Shu in some 36,253 volumes of over two million double pages, with its subsequent duplication in seven hand-written copies in the 1780s, required extensive supplies of high-grade paper. A special kind of fine and sturdy white paper made in K'ai-hua, Chekiang, was especially selected for printing the books at the Wu Ying Tien, which were known as palace editions (tien pan).

The recent discovery of some stone tablets containing regulations for the management of paper factories has revealed working conditions and wages of paper workers in the early Ch'ing period. One tablet from Soochow, of 1794, says that some thirty-six paper factories employing more than 800 workers were operating in the three districts of Shang-yiian, Chihiang-chou, and Wu-lien in the prefecture of Soochow. Most of the workers came from nearly Chia-ng-ning (Nanking) and Chen-chiang. Every three to six factories in and outside the city were organised into a ward for the purpose of enforcing the regulations and inspecting the working conditions within each ward. The workers included permanent technicians, temporary employees, and apprentices, who were managed by a superintendent and foremen and watched over by inspectors. Workers received a monthly allowance of 7.2 ch'ien in 1757 and 1.2 taels of silver in 1794, in addition to room and board. Wages were counted by the piece at the rate of 600 sheets per working day, not by the number of days in a month. A monthly bonus of 35 ch'ien was awarded to workers who put in extra hours or exceeded their quota of production. Apprentices received a stipend and were qualified after an indeterminate three years. The names of all workers were registered in a factory roster, and they were not allowed to transfer to another factory if dismissed for violation of working regulations. They were required for moral reasons to stay in the factory dormitory at night.

Another table, dated 1757, concerning an agreement by thirty-four paper factories of the same three districts in Soochow reveals that each paper dyer was paid 24 ch'ien per day for dyeing 100 sheets of green paper, and a bonus of 2. ch'ien for every additional 100 sheets. For 1000 sheets of red paper the pay was 32 ch'ien, with 5 ch'ien for every additional 100 red sheets. The table records some twenty-three different rates for dyeing different kinds of paper. The improved workmanship of hand-made paper in China suffered a rapid decline after the market was invaded by foreign papers in the middle of the 19th century. As the historian Lai Chin-Tao remarked, production of handmade paper was slow, and its price was high; it was not suitable for machine printing and could not compete with machine-made papers from foreign countries. The greatest consumption of paper at that time was for printing newspapers and for wrapping, but handmade paper, which could not be printed on both sides, was not suitable for newspapers. Moreover, imported wrapping paper at fifteen cents a pound was cheaper than mao-pien at twenty-six cents. In Chihien-shan (in Chiangsu), for example, paper production was worth half a million taels of silver each year before the end of the 19th century. After the introduction of foreign papers, the business dropped to less than 100,000 taels. In Shih-ch'eng (Chiangsu), eighty to ninety per

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1. The complete text of this table is given in Lien Yung-Chang (5), pp. 83–97. According to a local record of about the same period, the factory employed a team of four workers for each vat—one each to fill, pound, check, and dry. Another source records that monthly wages were 3 ch'ien in Fukien in 1794, 5 ch'ien in Chiangsu in 1781, and in Chekiang in 1707; and 5000 taels in Shantung in 1781; see Puang T'ieh L' (1), p. 96.7. In the Ch'ing dynasty, the unit chin equated one-seventh of a tael (long) or Chinese ounce, and 1000 pieces of coins (tsun) or copper equated one-tenth of a tael of silver.

2. See partial text reported in W.F. T. L., 1958, no. 9, pp. 30–52; the cost of rice was mentioned in one tablet as 1.5 tael of silver per pottle in 1716.
cent of the handmade paper mills had closed by the beginning of the twentieth century.9

(c) TECHNOLOGY AND PROCESSES OF PAPERMAKING

THE TECHNICAL aspects of papermaking include the materials, tools, and methods of manufacture. From ancient times Chinese papermakers had wisely selected almost all the kinds of plants known to the modern paper industry as producing the best of fibres and yet being most economical in cost. The application of chemical agents for sizing, loading, coating, colouring and dyeing was also known to them not long after paper was invented. The use of water as an inexpensive agent contributed not only to the swelling and bonding of the fibres but also to the increase of the mechanical strength of the paper. Such utensils as the vat, mould, and press used many centuries ago in China are still basic to modern papermaking, as well as the processes of maceration, washing, lifting, pressing, and drying. Historians of paper have agreed that the ancient principles and practices of papermaking were the basis upon which modern paper machines are designed and operated. The following pages will examine in detail some of these traditional materials, tools, and methods used before the coming of the machine age in Chinese papermaking.

(i) RAW MATERIALS FOR PAPERMAKING

According to studies of existing specimens and documentary evidence, a broad variety of vegetable fibres was used as raw material for papermaking in China. Almost all plants produce fibres, but only those rich in cellulose, abundant in supply, easy to treat, and cheap in cost are most suitable. Especially satisfactory are those plants containing higher yields of cellulose but lower in binding substances, which must be eliminated in the process of maceration. These materials include the bast plants, such as hemp, jute, flax, ramie, and rattan; tree bark of mulberry and paper mulberry; grasses, such as bamboo, reeds, and stalks of rice and wheat; and such fibres as cotton. Hemp and cotton are probably the best, producing the highest yields of pure fibres, but as they were needed primarily for the textile industry, paper mulberry and bamboo became the chief raw materials for papermaking in China.

Chronologically speaking, hemp was probably the earliest material used for papermaking from the Former Han (–206+8), followed by paper mulberry from the Later Han (+125+220), rattan from the Chin (+255+420), bamboo from the middle of the Thang (+618+906), and straw probably from before the Sung dynasty (+960+1280). Except for hemp, which was no longer used in large quantity after the Thang, and for rattan, the supply of which was exhausted since

8 See Liu Ch'iu-Tso [1], pp. 11396, 1151-4, 11419-20.

Fig. 1064. Hemp and its fibres (+8), from the Former Han specimen found at Fu-Feng, Shensi in 1928.

the early Sung, these materials have been continued in use until today. The use of raw fibres for papermaking varied a great deal according to the local production of the materials. Su I-Chien4 (+957+95), author of the first treatise on paper, said that hemp was used in Szechuan, bamboo in Chiangsu and Chekiang, mulberry bark in the north, rattan in Shan-chi, and seaweed by the people in the south. Paper made of wheat stalks and rice straw by the people of Chekiang was brittle and thin; and that of wheat stalks mixed with rattan from Yu-chhia was the best.4 This seems to be true both of earlier as well as later times.

(i) Hemp, jute, flax, and ramie

The plants which yield the richest and strongest bast fibres were the earliest materials used in Chinese papermaking known to us. The major varieties of the bast-yielding group are hemp (Cannabir sativa), known in Chinese as ta mu4, jute (Corchorus capsularis) or huang mu4, flax (Linum perenne), yu mu4, and ramie or China grass (Boehmeria nivea), chu mu4. They were grown in all parts of China, especially in the northern and western regions. Ancient Chinese documents refer to all of these varieties as mu, which has generally been rendered as hemp (Fig. 1064). This was probably the earliest fibre plant used for clothing in China before the extensive use of cotton fibres for textiles ever since the Ming dynasty. Ramie or China grass is a perennial plant, Sung Ying-Hsing (+1600+60) described two varieties of ramie, green and yellow. Their stems could be cut two or three times each year; from these fibres were obtained materials for making summer clothing, curtains, and mos-
quito nets. Most of the ancient papers were made either of used materials or raw fibres from these plant bast.

The oldest paper specimens of the Han dynasty discovered in Lop-nor, Pa-chiao, Chu-yen, and other places were all made of hemp. Those papers from the +3rd to the +8th century found in Sinkiang consist of, besides mulberry bark, chiefly raw and fabricated fibres of hemp, flax, and China grass. The manuscripts found in Tunhuang, dating from the +4th to the +10th century, were also made chiefly of hemp, jute, and China grass.

Hemp paper, which is described as pliable but tough, fine and waterproof, was especially popular for use in calligraphy, bookmaking, and official documents. It was used for writing by noted artists and for manuscripts in the Chin dynasty. Those produced in Szechuan in different sizes and colours were especially chosen by the Thang court for writing decrees, daily instructions and orders, and other official documents. It is said that the scholars in the Academy of Assembled Worthies (Chi Hsien Shu Yian) were provided every month by the court with 5000 sheets of hemp paper made in Szechuan. In the Khai-yuan period (+713–42), all the books in the imperial collections in the two capitals were written on hemp paper made in I-chou (modern Szechuan). No specific mention of hemp paper is found after the Thang dynasty. It is assumed that since then hemp has not been the chief material for papermaking. The reason why it was the first material used in papermaking was the discovery that a sheet of hemp and similar fibres drained on a mat gave paper. Hemp was also used for papermaking in Europe before the early 10th century, when wood pulp was commercialised, though even today, many high-quality papers are still made of hemp. However, being more in demand in China as a material for textiles, ropes, and other uses, it was gradually replaced by rattan and especially bamboo since the time of the Thang dynasty.

(ii) Rattan

The climbing rattan (Calamus rotang) (Fig. 1065) is known to have been used for making paper in certain regions in China, especially in the southeastern part corresponding to modern Chekiang and Chiangsi, where paper made of this plant, known as shang-chhi, was popular for almost a thousand years. The origin of the use of rattan for papermaking may be traced back to the +3rd century at Shantak-shu (modern Chihang-hsen, Chekiang), where rattan plants were said to have spread

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6. C. Horne (1), p. 865 ff.; Carter (1), pp. 6–7; Phan Chi-Hung (3), pp. 34–5, reports over 90 per cent of paper specimens found in this area are made of hemp materials.
7. See the analytical studies of Tunhuang papers by Chepperson (1), p. 10; Giles (77); Phan Chi-Hung (2), pp. 40–1.
11. 張蘊 書院 1 益州 2 郭漢 1 綺園

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over hundreds of miles on the mountains along the Shan-chhi river. The old paper made of rattan from Shan-chhi has been called Shan chang, or rattan paper of Shan-chhi. Fan Neng (+339–910), a native of Honan and an official who served in the capital, said that locally made paper was not suitable for official documents and it was ordered that rattan and bark paper be used instead.

Rattan paper became most popular in the Thang dynasty and the area of its production was greatly extended beyond Shan-chhi to many neighbouring districts in Chekiang and Chiangsi. During the first part of the +8th century, it was recorded in official gazetteers and other documents that paper was an item of local tribute from some eleven districts, including Hangchow, Chhii-chou, Wu-chou (in modern Chekiang), and Hsin-chou (in modern Chiangsi). From where rattan paper was exclusively sent, some of the districts being said to have sent as many as 6000 sheets at one time. A special variety of rattan paper made in Yu-chhiang village of Hangchow, known as ‘Yu-chhiang paper’ was especially popular.

Rattan paper, described as smooth, durable, with fine texture, and in different colours, was selected for bookmaking, documents, calligraphy, and other uses. The administrative codes of the Thang dynasty specified that the white rattan paper be used for decrees on bestowing, requisition, and punishment; blue for sacrificial messages at the Taoist temple of Chhiang Kung, and yellow for imperial instructions and orders. The famous calligrapher Mi Fu (+1051–1107) said: