

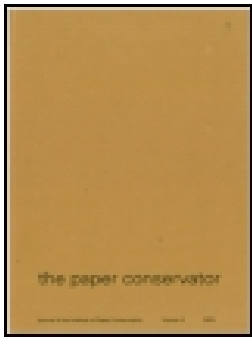
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XUAN PAPER

Hilary Mullock

In the East, paper has traditionally had a thousand uses quite different from those in the West. When visiting China one is immediately struck by the number of objects still made of natural materials, rather than plastics and synthetics. Containers, packaging and wrapping are often complex paper constructions. Intricate patterns and scenes are made by paper cutting; children's toys are paper folded into life-like forms of insects and birds; paper kites are shaped into images of fish, butterflies and birds; paper flowers decorate houses and even bicycles. Paper formed into elaborate wreaths, banners and flags are still prominently displayed at Chinese festivals and at funerals. Joss paper replicas of animals, money and worldly goods are burned at Chinese funerals to satisfy the spirits of ancestors. Originally these spirit papers were made by hand in the paper mills such as those found at Zhejiang, where some 24,437 mills were recorded in 1933.¹

Imports of cheaper, foreign machine-made paper caused a steady decline in handmade paper mills of some 80 per cent. Now the general purpose papers such as those for packaging, wrapping, toilet and newsprint papers are mass-produced by machine from locally grown fibre. However, isolated areas remain where the greater part of the paper is still handmade. For example, the minority Bouyei people living in the remote limestone valleys of Guizhou province, south-west China, make a bast-fibred paper using vats built into the hillside.

Most of the mills still making handmade paper in China are producing a specific type and size of paper for particular purposes. One such paper is Xuan paper—a smooth white paper used by calligraphers and artists, made from the bast fibre of the *than* tree (*Pteroceltis tatarinowii maxim*), mixed with rice straw (fig.1). Xuan paper is said to have originated in Xuancheng in Anhui province during the Tang dynasty, where an annual tribute of Xuan paper was made to the Tang imperial court.² There is a Chinese legend that tells the story of a poor paper maker who found a *than* tree fallen into a river; the whiteness of the soaked and rotten branches inspired him to make paper from its fibres.



Fig. 1 A *than* tree (*Pteroceltis tatarinowii*) as seen at the Royal Botanical Gardens at Kew. The bast fibres are mixed with rice straw pulp to make Xuan paper.

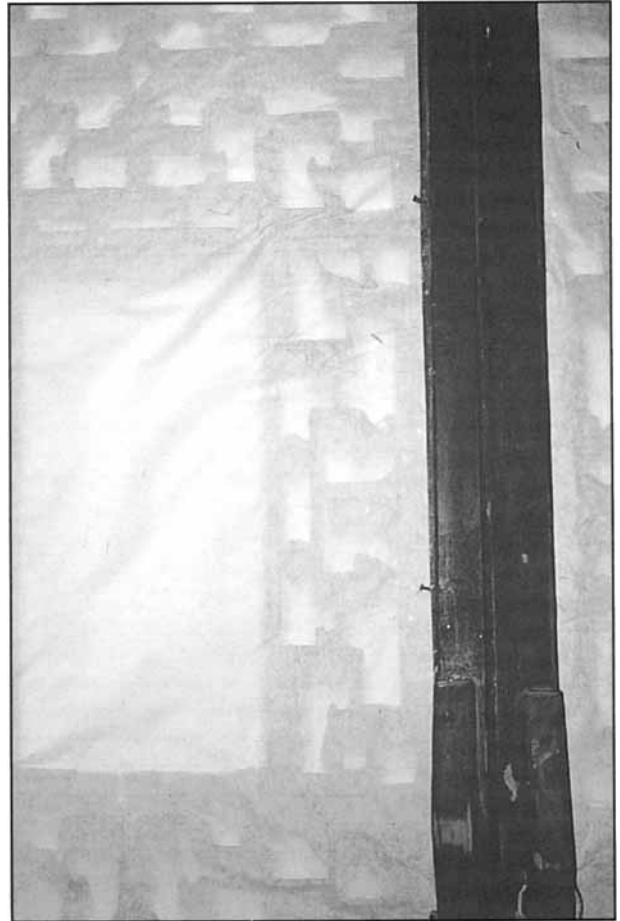


Fig. 2 Xuan paper stretched over a window frame.

The strength and whiteness of the Xuan gives the paper many traditional uses. Xuan paper can still be seen stretched in layers over geometrically carved sandalwood lattices in old-styled windows, allowing a soft light to diffuse through the semi-opaque paper (fig. 2). Most houses display a hanging scroll decorated with calligraphy, paintings or decorative rubbings taken from inscriptions or engraved designs found on stone stelæ. The author recently visited China and saw Xuan paper being used to take rubbings from exhibits in the Museum of Stelæ, Xian: a damp paper was drummed over the face of the stone, a tapping movement with a stiff brush pressing the soft paper into every depression. When the paper had dried taut, the ink was applied on an inked pad to form a white image on a black background.

A variety of Xuan papers are for sale in the famous publishing and art material store Rong Bao Zhai in Beijing. The shop is in Liu-li-chang xi-jie, a street where artists' materials are sold, and where every window is filled with a selection of beautiful artists' equipment: carved ink slabs, phials of pure ground pigment, brushes of every shape and size. The purest than fibre paper comes from Anhui province. There are also Xuan papers from Sichuan Province and Zhejiang. The best grade of Xuan paper is very

smooth and white, with a hexagonal pattern of chain lines and a red edge stamp which means 'Tortoise grain, Anhui Province'. Rong Bao Zhai also sell books hand-printed on Xuan paper and bound in dark blue Xuan paper covers, sewn with white silk. They have a scroll-mounting studio where papers used for mounting must be carefully chosen to provide strength and weight, yet retain the suppleness of the original. The mounters confirmed that the Xuan paper made today in Anhui was the best quality paper. It was the most popular amongst the artists, from various parts of China, to whom the author spoke. All stressed the importance of using good-quality absorbent, soft paper and referred to such paper as 'Xuan', yet very few of them knew where or how it was made.

In defining the quality of a good handmade artists' paper it is necessary to consider first the working methods of the painter. Subject and technique in China are treated very traditionally. Both painter and calligrapher regard the space surrounding the image as being of equal importance to the image itself, and therefore the tonal value of the paper support plays an essential part in creating that image. The surface texture must be suitable for the wet application of pigment and have the ability to suit the style of painting and complement the final appearance of the work. The accepted format for scroll painting requires a long vertical sheet of paper approximately 1380 x 700 mm, white, soft, smooth and flexible enough to withstand repeated rolling and unrolling. The scroll mounter might use several layers of paper to support a painting on thin paper, or alternatively use a thin sheet to line a heavy weight paper. A piece of calligraphy is valued as among the most precious possessions of a household. It is handled with care and may only be exposed to light during certain seasons. The survival of many paintings is partly due to preservation through mounting. It is expected that the artist's paper and its lining will be made of the purest and most durable materials—the same criteria apply to them as to the materials used by the conservator.

In the Hangzhou area of Zhejiang there is a factory where paper is still being made by the same methods as those recorded in the Ming dynasty.³ Zhejiang became a highly developed commercial, political and cultural centre in the twelfth century when the Song dynasty moved its court to Hangzhou, the capital of the province. Towns such as Hangzhou, Shaoxing and Suzhou continue to prosper as important trading centres, due to their proximity to the Yangtze river delta and the sea. They were connected by a network of waterways and canals, and their beauty has been a source of inspiration to artists through the ages.

All the varieties of paper seen in production at the Zhejiang Xuan paper factory had the qualities required by artists and conservators, and were collectively named 'Xuan'. The papers have a very even pattern of fine chain and laid lines imprinted by the thin slats of a bamboo mould screen. The paper is a laminate

of one to sixteen layers or *chih*, built up by the action of the vat man as he forms layer upon layer of pulp in the mould. The finished paper is named according to the number of these laminated layers, such as *su chih Xuan* (four sheet Xuan) and *shih lieu chih Xuan* (sixteen sheet Xuan).⁴ Fibre length in Xuan paper is shorter than generally found in Japanese papers and consequently tear strength is not as great, but strength is imparted by the web of lamination. Whorls of fibre can be deliberately arranged to form the uneven blotches of white in the grade of Xuan paper called 'Tiger skin', or dappled to imitate a cicada's wing. The paper may be given the appearance of age by an application of a natural insecticide *Phellodendron amurense*, or coloured blue or yellow with vegetable dye such as indigo or rattan, or even sprinkled with mica dust and gold leaf.

The drive to the Zhejiang Xuan mill follows the course of the Fuchun Jiang river, through a landscape painted white by the dust that blows from the limestone quarries and kilns in the hills. It is the perfect environment for papermaking, given the alkaline geology and an abundance of water for making and transporting paper. The factory consists of several low brick barn-like structures, grouped at the end of a large pond which drains into the river. The central building houses three large vats in a row, each brimming with white pulp. Each has its own papermaker who holds a large mould-frame by means of deckle sticks attached to the sides of the frame. The Chinese use a 'laid transfer' type of mould: an outer rigid rectangular frame made of bamboo, with vertical ribs, supports a flexible laid-mould cover (fig. 3). The mould-cover is a thin mat made of fine slithers of bamboo (sliced by drawing through a tube that has sharp blades at one end), joined together with horsehair, cotton, or silk. It is removable and fits inside the inner edge of the frame, which measures 1380 x 700 mm. The vat man rhythmically scoops up pulp onto the flexible screen, shakes the frame from side to side to form an even layer, and flicks off any excess pulp from the front edge (fig. 4). A bamboo pole suspended horizontally under the frame by a pulley system suspended from the rafters, helps to control the heavy frame. The pole and pulley also acts as a base on which to rest the frame while the papermaker, in a flowing movement, lifts off the mould-cover, turns to his right and couches the newly formed sheet. The cover is rolled away to leave a smooth and unwrinkled sheet of paper. The indentation of the transverse strips of bamboo creates a very even pattern of laid lines. Pulp is added to the vat at regular intervals, and the mixture is agitated with a long paddle to prevent the fibre from settling out.

In an adjacent room a dark blue book-cover paper is made. All equipment and the vat containing the indigo-dyed pulp is kept well separated from the white papermaking operation. *Indigofera* is a plant native to China, whose leaves yield the permanent colour traditionally used to dye textiles and paper.

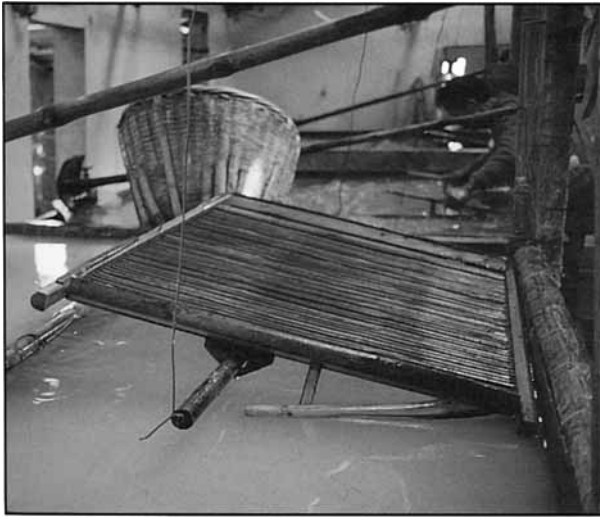


Fig. 3 A bamboo papermaking screen supported by a pulley system over a vat of pulp.



Fig. 4 A paper factory in Zhejiang province. The papermaker is forming a sheet on a bamboo screen.



Fig. 5 Paper drying on a hollow wall in a Zhejiang paper factory.

A large wooden press stands in the yard. The post of wet papers is pressed between boards overnight, and then the last remaining water is absorbed by the heated walls of the drying room. This is a long chamber where a central hollow wall is heated at the base by a wood-burning stove whose chimney disappears through broken slates in the roof. Two men work side by side moving down each side of the heated wall. The wall is painted with a watery solution of paste to prevent the paper from slipping, and to give a light application of size to one side of the sheet. The men separate each sheet from the pile by blowing on a corner; then with one hand they take the top edge of the sheet and place it against the wall while with the other hand they quickly brush the paper flat (fig. 5). After two minutes, the now dry sheets ripple off and are placed flat in a pile. The combination of paste and heat gives the paper a smooth texture, with brush strokes visible on one side. Minute deposits of calcium are visible on the surface.

The last room, approximately five metres square, is entirely taken up by an enormous granite circular trough. Two men push the bar of a giant pestle around to grind the fibrous pulp in the trough. The type of pulp in the vats is kept secret, although the director of the mill said that there was plenty of raw material, obtained locally. He insisted that neither alum nor mechanical wood pulp was used and that weak calcium hydroxide was the only bleach allowed. Bamboo provides the fibre traditionally used in Zhejiang province. Dard Hunter also mentions the use of rice straw and the bark of trees, and the pulp may have been a mixture of these two fibres.⁵ The head of the botanical gardens at Hangzhou said that Zhejiang was too far east for the cultivation of *than* trees, which are native to central China. Bast fibre could, however, easily be transported on the efficient network of waterways.

Papermaking methods in Zhejiang closely resemble those of hand papermakers in Japan. By contrast, the enterprise in Anhui is obviously considerably larger and more modernised. Illustrations in the factory brochure show a line of very long vats, with two vat men manipulating the big screens without the aid of pulleys. Large Hollander beaters can be seen mechanically beating the pulp, and paper being dried on heated metal walls, while a room full of workers folds and grades the newly made paper.

Paper Fibre

China covers a vast area with many variations in climate and vegetation. The harvesting of specific plants for paper pulping therefore has a topographical significance. The principal fibres used for machine and handmade paper are bamboo, rice straw and hemp. Large areas of hemp can be seen growing along the slopes of the upper Yangtze and the Daning river in Sichuan province, and mounds of the fibre are piled up on the shore to dry in the sun, ready for transportation by barge to cities like Wuhan that specialise in making an unbleached heavy-duty machine-made packaging paper and a smooth off-white printing paper.



Fig. 6 Fine mesh bags of rice pulp are suspended in fast flowing water to remove impurities and bleach.

Rice is widely grown as a food crop south of the Yangtze and the stalks can be easily and cheaply processed to form a pulp. After the seed is removed, the stalks are pounded and then layered with lime in a circular stack for six months, after which the straw is thoroughly decayed. The pulp is placed in fine mesh bags, suspended from a pole, and left in the river to let the flowing water remove the lime (fig. 6).⁶ Rice straw alone yields a soft, weak paper and therefore is usually mixed with another fibre, but mills in the Tunxi area of Anhui province, Huizhou county, specialize in producing a machine-made soft absorbent paper purely of rice straw, for sanitary purposes.

Bamboo (formerly *Bambusa*, now more properly assigned to *Arundinaria*) cannot be cultivated in the northern provinces of China, but is abundant in the Yangtze valley southwards. It is a major source of raw fibre because of its rapid growth and low cost. The three varieties most used for paper pulp are: *ch'ing kao*, *pai liao* and *huang liao*. It is difficult to bleach bamboo fibre and a strong bleach is needed to whiten the pulp.⁷ The Chinese prepare bamboo for papermaking by allowing the canes to stand for a prolonged time in water until the outer green bark can be removed. The split core of wood is stacked in a pit and retted in a lime paste for several months, before the softened stems are finally ground for pulp. Bamboo blends well with any other stock and, mixed with rice straw, can produce a first-class paper for stationery and printing. Left unbleached it is suitable for newsprint or Kraft paper.

Like Japanese handmade papers, the Chinese artists' papers contain a proportion of bast fibre, *Pi*, which is the inner layer of the bark of shrubs or coppiced trees. When coppiced, the tree produces the essential supply of straight branches needed for processing into pulp. Coppicing is done in strict rotation, every three to seven years. A good Japanese handmade paper contains almost 100% of one of the long-fibred bast plants such as *kozo* (*Broussonetia papyrifera*), *mitsumata*

(*Edgeworthia papyrifera*), or *gampi* (*Diplomorpha canescens*). Fibre analysis at the British Library showed that Chinese papers tend to contain a mixture of fibres with a much lower percentage of bast fibre. Bretschneider, a physician to the Russian legation in Beijing in 1881, recorded in his notes on the flora of China that the fibrous bark of a tree resembling paper mulberry was used for making paper.⁸ Twelve out of fifteen Chinese papers held at the British Library were found to contain a small proportion of either *kozo* or *than* mixed with a grass fibre. *Than* (*Pteroceltis tatarinowii maxim*) is a deciduous tree, native to central China. It is known in the West as wingceltis and was introduced to the Royal Botanical Gardens at Kew in 1897.⁹ Only one specimen is hardy there and it has been reported that the tree is impossible to cultivate in Japan.¹⁰ More information about its habitat emerged during a visit to Mount Lushan museum, in central China, where there was an interesting display of local plants of the region including a specimen of the Xuan paper plant *than* (fig. 7). *Pteroceltis tatarinowii maxim* is a member of the *Ulmus* (Elm) family, botanically classified as *Urticales*. Other members of this group share a common characteristic: all the species have been used by man in a similar way, that is to make cloth or paper. Examples included in the group *Cannnabinaceae* are hemp (used for rope and paper) and hops (used for making a white textile in Sweden); *Ulmaceae* include celtis and elm (used for making rope and matting in Japan and Russia; nettles from the *Urticaceae* group are used for cloth-making; *Moraceae* includes *Broussonetia papyrifera* (paper mulberry) and an African species called *Antarius toxicana*, the inner bark of which is used for paper and tapa cloth.¹¹



Fig. 7 A botanical specimen of *Pteroceltis tatarinowii maxim* at the Mount Lushan Museum.

Samples of *Pteroceltis tatarinowii* from Kew were retted in water for a prolonged period to obtain fibres for microscope examination. The black outer bark peeled away easily to reveal a bright white inner bark (fig. 8). Photomicrographs and microscope analysis (x 200 magnification) of the fibres proved that they were a long fibre, up to 800 microns in length. The width was fairly even (approximately 16 microns) with horizontal markings at irregular intervals. They are only one third the length of *kozo* and considerably thinner, without joints or nodes (fig. 9).

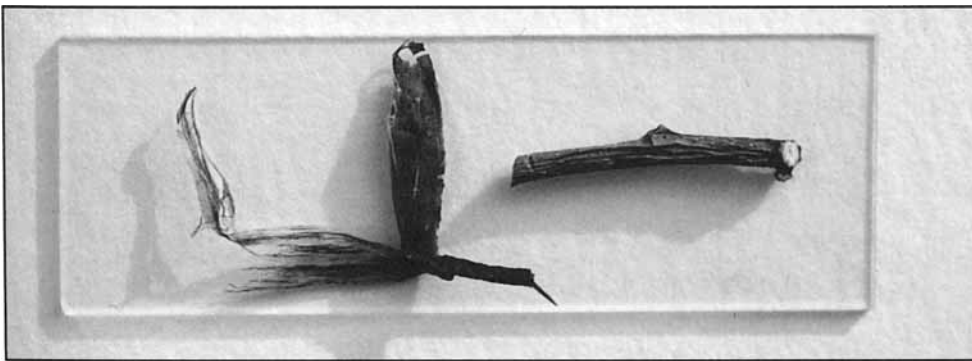


Fig. 8 A sample of bark from the Chinese papermaking plant *Pteroceltis tatarinowii maxim* prepared for microscopic examination.

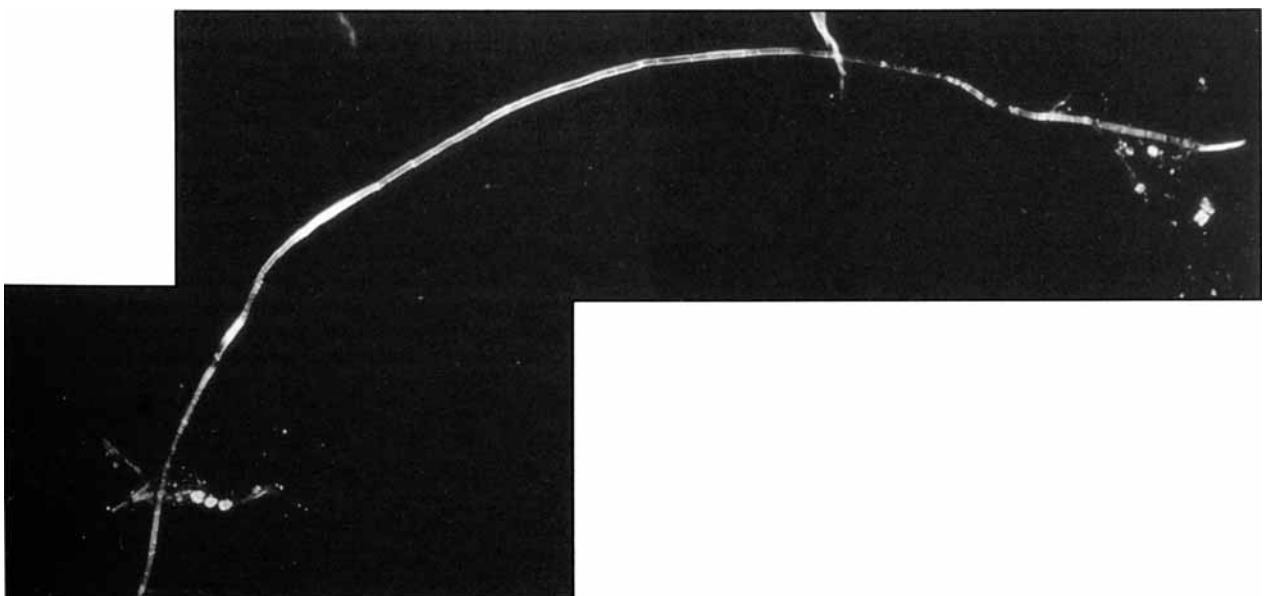


Fig. 9 Micrograph of *Pteroceltis tatarinowii maxim* x 200.

Pteroceltis tatarinowii is generally grown from cuttings. After two years the branches are of sufficient width (33 mm or one Chinese inch) to harvest for papermaking purposes. The method of fibre preparation is similar to that used for paper mulberry. The branches are harvested in winter and tied into bundles. These bundles are steamed for two or three hours to allow the outer layers of bark to be stripped more easily from the stems. The bark is collected and left to rot in water for several months until the outer black bark has sufficiently decomposed. All traces of the black outer layer are removed so that only the white inner bark is used for pulping. It then requires further bleaching in a mild alkali and final rinsing in running water. Bleaching by laying out the prepared pulp along the bank of the river or on the hillside has been reported. Prepared rice straw pulp is added to the bast fibre in the vat to enhance the natural sheen of the paper: rice straw pulp is also considerably cheaper and easier to prepare. The quality of Xuan paper is obviously altered by the addition of grass fibres: 100% bast fibre pulp is known as *Tran pi*, 70% bast is *Qu pi* and 50% is *Ban pi*.

Various mucilaginous plant substances have been described as being important additions to the pulp, similar to the Japanese use of *neri*, keeping fibres in even suspension and preventing them from knotting or draining too quickly from the mould. This mucilage also imparts a smooth texture to the sheet obviating the use of gelatine size. Plants recorded as a source of mucilage are: the wood of *Cedar machilus thunbergii*, the leaves and twigs of *Ilex pubescens*, *Hibiscus syriacus*, *H. esculentus* (okra) and *H. abelmoschus*. The hibiscus species are the most likely material, as all roots when washed, sliced and soaked in water, readily produce a sticky juice.¹²

Chinese papers and conservation

The Laoning Provincial Museum employs a team of five paper conservators to work on their collection of well over 10,000 items of calligraphy, painting and ancient maps. Many of these items are on display as hanging scrolls requiring regular remounting and repairing. The conservation studio is furnished with large red lacquer tables on which the long scrolls can be repaired. The repair of a scroll can take up to three months and a team of four conservators is necessary to manipulate the large size of the paper. Xuan paper is always selected as it is considered the purest handmade paper. The long fibres in Xuan enable the paper to sustain strength during wet conservation treatments and withstand fairly rigorous handling when wet and dry. Supplies of the paper are delivered by salesmen from Xuan paper factories all over China: from Sichan, Zhejiang and Hebei provinces, and from Jing Xian in Anhui province. This proves that mills in different areas are still producing good quality Xuan paper for artists. Paper from Jing Xian is generally selected for remounting the scrolls as it contains a greater proportion of *than* to rice fibre.

The weight of paper chosen for mounting and backing depends on the weight of the original. If the painting or calligraphy is on a heavy support, a single layer *dan Xuan* backing paper is selected, as this will have a minimal amount of shrinkage and stretch when wet, and will cause the original the least amount of stress. Likewise, an object on a thin, fragile support will be mounted on one or more layers of paper to give strength and flexibility. All the materials used in scroll mounting are carefully chosen for weight and purity. Wheat starch paste is made up daily and sieved and diluted as required. Lengths of paper were dyed to be compatible with the colour of the original, using vegetable dyes; these papers were then hung from the ceiling to dry in preparation for mounting.

In order to insure that fugitive pigments and inks remained stable during treatment, the area was painted with gelatine. The Chinese artist traditionally painted animal glue and alum over his painting as a fixative: the alum hardened the glue to prevent the gelatine dissolving. Although the alum is acid and causes problems to the paper, the pigments are generally stable. The conservators used natural earth colours to retouch missing areas of paint.

Repairs are made after the old backing layers have been removed, using a thin Xuan paper and starch paste. Relined paintings are left to dry on the walls for several months. Smaller items are conserved and mounted into accordion-folded albums. The painting is repaired and rebaked with a thin layer of Xuan paper 2 mm larger than the original. More layers of Xuan paper are pasted together to the exact height of the object and its backing: the object is then inlaid and backed with five layers of Xuan paper to provide an adequate support. The number of pages in each book varies: for example, a book containing eight pieces of artwork would have twelve pages—the first, second, eleventh and twelfth being blank, as they form the covers. In this way the paintings are kept clean and flat, and the large margins protect the object from direct handling. It provides an excellent method of storing collections of valuable material (fig. 10).

There are many types of paper made in China today quite distinct from those manufactured anywhere else in the world. Despite the similarities to papermaking equipment, paper formation and the final practical application of paper in Japan, there are differences in the texture, strength and colour of the Chinese papers. The reason for this is China's use of particular combinations of indigenous plants for pulp. In contrast, Japan uses only bast fibres for handmade paper. All the traditional Chinese paper fibres have a specific characteristic and therefore fulfill a specific purpose. The selection of a fibre or a mixture of fibres is chosen to enhance the finished product: for example rice straw produces a soft paper but is added to other fibres to produce a silky texture; hemp paper is strong but is usually left unbleached. Almost three quarters of the



Fig. 10 The paper conservation studio at Laioning Museum, Shenyang. A concertina-folded album is being prepared and scroll paintings are being remounted.

production of paper in China comes from bamboo or a mixture of bamboo and rice straw. Although this fibre can produce a very high grade artists' paper, over-bleaching and poor processing can also result in a weak, poor quality paper. This type of processing has sadly created a poor image of Chinese paper abroad. Papers containing a percentage of the Chinese bast fibre *Pteroceltis tatarinowii* are generally superior in texture and strength due to the long length of the fibres. There is an obvious need for artists' handmade papers and the Chinese consider the making of high quality Xuan paper as part of their national heritage. The best Chinese paper is technically comparable to Japanese paper and it is hoped that the number of handmade paper mills in China will increase and that greater quantities can be exported.

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Summary

This article describes the contemporary production of a Chinese handmade paper called 'Xuan' used by artists and calligraphers. The preparation of pulp and the production of the paper, as seen in a papermaking factory in Zhejiang Province on the East Coast of China, is reported. Analysis suggests the predominant fibre to be a Chinese bast fibre from the *than* tree (*Pteroceltis tatarinowii maxim*). The combination of the long, strong, bast fibre, mixed with short rice straw fibre, produces a white silky paper comparable in strength to some Japanese handmade papers.

XUAN PAPER

The author illustrates the practical uses for Xuan paper and describes the deep appreciation for the paper found in the paper conservation studio of Laioning Museum in the Northern province of Shenyang.

Résumé

Cet article traite de la production contemporaine en Chine d'un papier fabriqué à la main, appelé 'Xuan', qu'utilisent les artistes et les calligraphes. L'auteur décrit la préparation de la pâte et la fabrication du papier telles qu'elle les a observées dans une usine au province Zhejiang, située à la côte est de la Chine. Les résultats d'une série de tests indiquent que le composant principal est une fibre de bast provenant de l'arbre *than* (*Pteroceltis tatarinowii maxim*). La combinaison des fibres de bast qui sont longues et fortes, et les fibres courtes de la paille de riz donne un papier blanc et soyeux dont la force égale quelques-uns des papiers japonais faits à la main.

Les usages particuliers du papier Xuan sont énumérés et l'auteur mentionne que les conservateurs du Musée Laioning au province Shenyang, dans le nord de la Chine, tiennent en haute estime ce papier.

Zusammenfassung

In diesem Artikel wird die zeitgenössische Produktion eines handgeschöpften chinesischen Papiers mit dem Namen 'Xuan' beschrieben, welches von Künstlern und Kalligraphen verwendet wird. Die Zubereitung des Stoffs und das Herstellen der Papiere wurden in einer Papierfabrik der Zhejiang-Provinz beobachtet und hier beschrieben. Analysen haben gezeigt, daß die vorrangig verwendete Faser eine chinesische Bastfaser des *Thuan*-Baumes (*Pteroceltis tatarinowii maxim*) ist. Die Kombination von langen, kräftigen Bastfasern vermischt mit kurzen Reisstrohfasern ergibt ein weißes, seidiges Papier, das in seiner Festigkeit mit manchen Japanpapieren verglichen werden kann.

Biography

Hilary Mullock completed her MA at Camberwell, where she wrote a thesis on Chinese papers, based on the collection in the British Library. She continues to work as a freelance conservator.

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