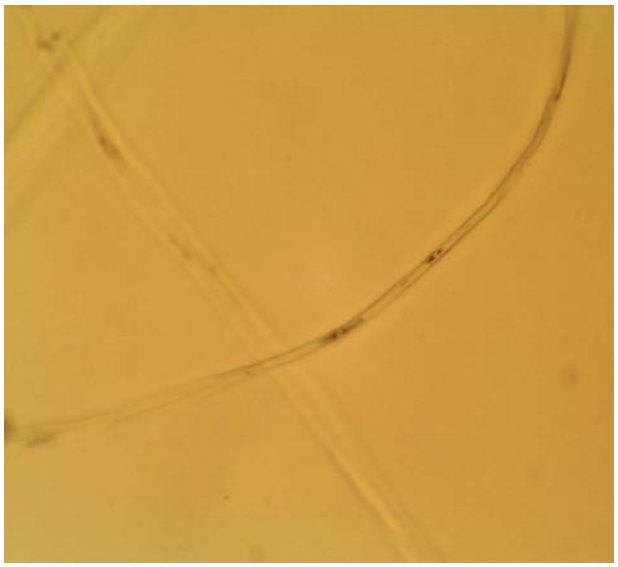
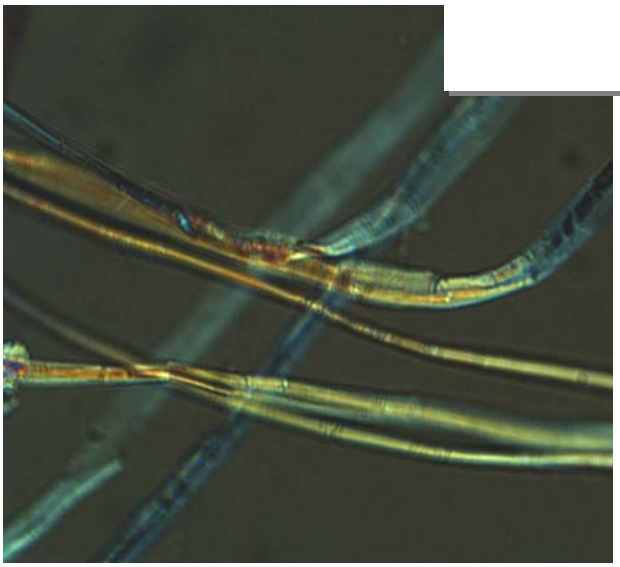
Gampi

Chemical Formula, ***Diplomorphs sikokiana***
Diplomorpha canescens or ***Wikstreomia retusa***



Microscopic appearance at x500 mag



Microscopic appearance under slightly crossed polars

Dates of Use
Ancient times up to the present day in Japan and the Far East in general.

Summary of Manufacture
Plant family *Thymelaeaceae*. The plant grows in mountain regions where it grows up to 1 - 1.5m in height. It cannot be cultivated which makes the resulting paper very expensive. Gampi is regarded as one of the most refined Japanese fibers.
Harvested fibers are around 2.5 to 5.3 mm in length.
Fibers are used from the branches which are harvested from the plant in the Spring.
As with most paper fiber preparation, the leaves are removed and the fiber stripped from the cored of the branch. The inner bark is removed from the outer by scraping and/ or peeling and the fibers soaked and cooked depending upon their intended use.

Brief History of Usage
Used for copy paper, tracing paper and for wood-block printing since 850 AD. The paper is also easily dyed and decorated and can be found as the support for screens, fans and parasols. Phillipene gampi is almost identical to Japanese but the fiber is courser due to the climate, producing an off-white, tan paper. Naturally grows in Japan, Nepal and Hawaii. (India??)

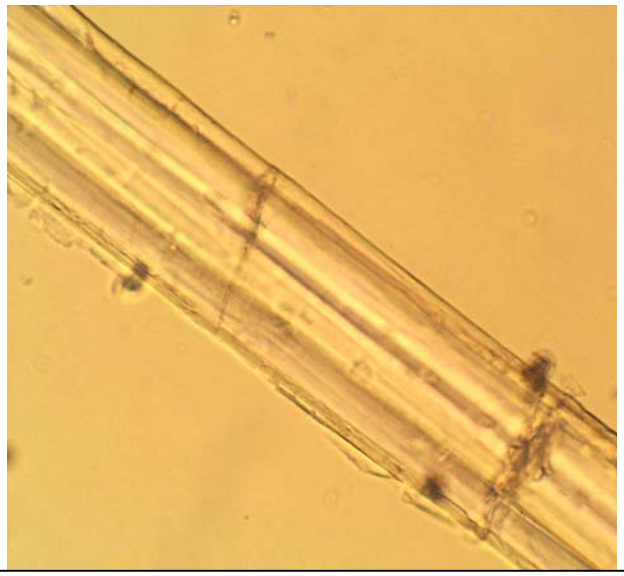
Surface Morphology / Microscopic Description
The paper is fine but strong with a warm tone, sheen and a pronounced rattle when handled. The sheet has visible chain and laid lines. The fibers are long, thin and regular in width with occasional markings or nodes. Cross striations are fine and well spaced but may group and extend across the fiber. The lumen is wide and has narrow, defined walls. The cell ends are roundish. The white bark comprises about twenty-two percent hemicellulose and 3 per cent lignin.

Aging Characteristics
Gampi fibers make strong paper with a lustrous sheen and a warm greenish/ yellowish hue.
Paper which appears quite green probably conatins more fibers from the inner bark only. That which appears tan in hue with flecks is likely to be a mixture of outer and inner bark.
Gampi has strong adhesive power between the fibers and the sheet is acid free.
The paper also reputedly has a strong resistance to insects. The latter properties make the paper resiliant deterioration.
It is also reputed to need less addition of binding mucilage added to the pulp as the fiber seems to retain a great deal of its own even after cooking.

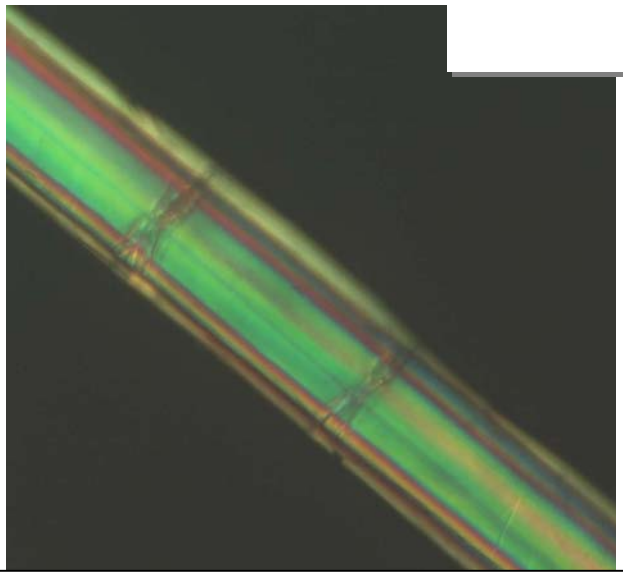
Technical Examination Techniques/ Chemical Staining Tests
Turns green/ yellow with the Hertzberg stain.

Hemp

Chemical Formula
From the stem of ***Cannabis sativa***



Microscopic appearance at x500 mag



Microscopic appearance under slightly crossed polars

Dates of Use
Ancient times to the present day.
For cloth, paper and today, illegally as a drug.

Summary of Manufacture
Plant family *Moraceae*
Derived from the bast fibers of the plant cannabis sativa.
Harvested fiber length is around 25 mm
Fibers are harvested from the stems of the weedy perennial or annual herb in the Autumn.
The leaves are removed, then the stems are usually steamed and the fibers stripped apart. Commercial preparation of the fibers, like with most others, the fibers usually undergo retting before being boiled with the addition of lye into the vat. The preparation the differs slightly for hemp being made into cloth as opposed to paper. Usually cloth preparation undergoes further cooking in a solution of lye.

Brief History of Usage
Course varieties have been used for centuries as the main fiber in sail and rope making. Finer fibers were used in cloth and textiles and occasionally it was used as a support for paintings. Commercial varieties are grown in Russia, China, Italy and Saudi Arabia, but the plant will grow in almost any conditions.

Surface Morphology/ Microscopic Description

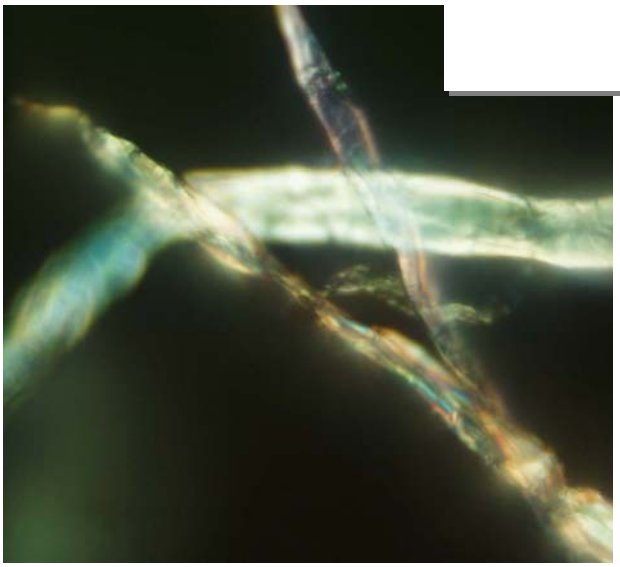
Aging Characteristics
Original paper colour is usually off-white.
Chinese paper was often fermented during fiber preparation giving it a finer quality and hence the main source of fine paper in China and as paper currency.

Technical Examination Techniques/ Chemical Staining Tests

Kozo

Chemical Formula ***Broussonetia kazinoki Sieb***
Diplomorpha canescens, family Moracae

Microscopic appearance at x500 mag



Microscopic appearance under slightly crossed polars

Dates of Use
Ancient times to the present day.

Summary of Manufacture
Family Moraceae.
Fibers yielded from the mulberry tree. As opposed to paper mulberry which is manufactured from the fibers of *Brousonetia papyfera*; the main sourceof kozo is derived from *Broussonetia kazinoki*.. There are however many varities of mulberry from which kozo is made but the latter one is considered to yield the best fibers. The tree is cut into section and cut branches left to steam in a pot of boiling water. After several hours when the bark has softened it is stripped by hand and hung to dry. The bark is then later soaked and stripped down from the outer balck bark into the inner green and white bark depending upon the yield desired for papermaking.

Brief History of Usage
The most widely used bast fiber in Japan; Kozo originates from around 105AD, from a mountain wilderness of Shikoko and Kyusu province of China. The kozo mulberry is closely related to the white and red mulberry trees commonly found in North America. The leaves of the variety, Moras alba L. are fed to silkworms in Japan.

Surface Morphology/ Microscopic Description
Known for its long, sinewy and strong fibers.
Fibers vary in length between three and twenty-five mm.
Fiber diameter averages .025mm.
The material constituents of the white bark of kozo averages approximately nine per cent and the lignin content about 4 per cent.
Thai kozo is less expensive than kozo grown in Thailand. The plant is identical botanically t the Japanese kozo, but due to the warmer climate they have different fiber characteristics. Chinese kozo is less expensive than Thai kozo and similar to Japanese in appearance.

Aging Characteristics
Generally kozo fiber contains very little lignin and therefore little inherent acidity. The fibers are long and physically strong and as a result the paper is durable and only mainly at risk from external factors of degradation. Over time however, the fiber furnish or surface of the paper can become fluffy as the long fibers undergo physical damage and abrasion across the surface of the sheet, the fibers twist and protrude from the surface.

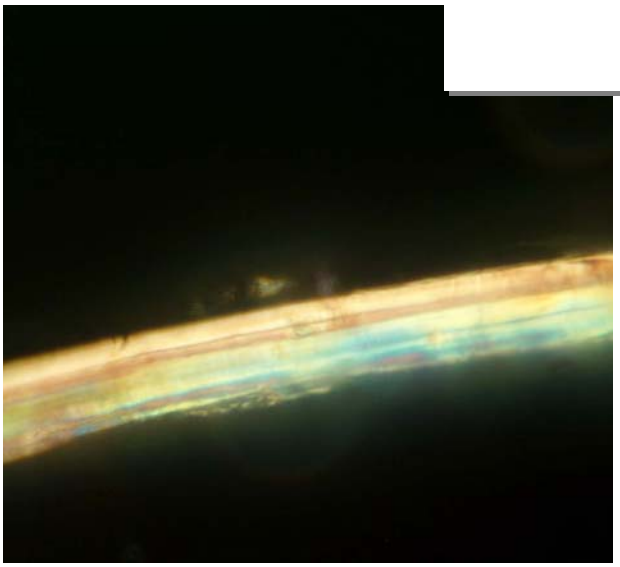
Technical Examination Techniques/ Chemical Staining Tests

Manilla

Chemical Formula

Manila Hemp, Abaca, Musa textiles Née

Microscopic appearance at x500 mag



Microscopic appearance at x500 mag

Dates of Use

Ancient times to the present day.

Summary of Manufacture

Plant family *Musaceae*

The leaf stem of tall perenial herbs are harvested and hence the fiber is a leaf fiber not a bast one. Fibers are around 3-7mm in length and are harvested in the summer months. The plants roots lie near the soil surface while above ground the plants commercial fiber is the sclerenchyma of the leaf bases. The plant can be cut after 3 years of growth but its yield decreases after approx 5 years of harvesting. The fibers are cut into pieces and soaked in water for a day. If being prepared for paper the fibers are then often boiled for a couple of hours in a solution of lye, beaten and made into sheets.

Brief History of Usage

There are 35 species of manila and of these *M, textilis* is the main source for fibers. The plant originates in the Philippine Islands where it was made into cloth from the sixteenth century and exported to Japan. From the seventeenth century paper was being made in Japan from the variety Musa sapientum (Basho). Varieties found in the Philippines, Uganda, Malaya, Bolivia and Japan.

Surface Morphology/ Microscopic Description

Its colour varies from yellow/ pink to a golden brown

Fiber tips tend to be tapering to a point or rounded end

Fibers are nicellular and approximately 5-10mm in length.

Cells appear oval in shape or circular in cross-section and with a distinct central canal which may often be less than half of the diameter of the fiber.

The fibers are tough and flexible and the nodes are usually not obvious.

The degree of lignification present depends on the individual fiber and can vary greatly.

Aging Characteristics

Generally fibers have a higher lignin content than other bast fibers resulting in higher inherent acidic content and therefore papers have a higher potential for acidic degradation and visible discolouration.

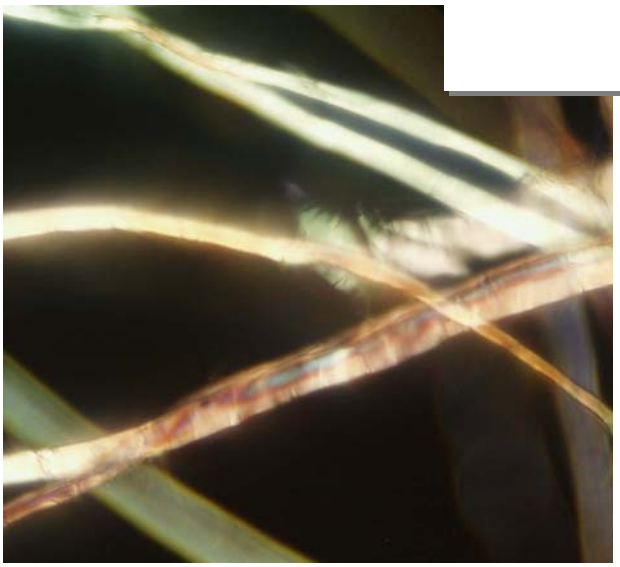
Original paper colour can vary from a tan/ buff if fresh leaf stems were used, to a pale yellow if rope was used; to a cream if dry fibers were prepared.

Technical Examination Techniques/ Chemical Staining Tests

Mitzumata

Chemical Formula *Edgeworthia papyrifera or Edgeworthia chrysantha*

Microscopic appearance at x500 mag



Microscopic appearance at x500 mag

Dates of Use
Ancient times to the present day.

Summary of Manufacture
Plant family *Thymelaeaceae, genus Edgeworthia*
Harvested fiber length is around 3mm.
The branches from the shrub are harvested for paper manufacture in late spring or early summer. Preparation involves the removal of leaves from the branches, which are then steamed and, as like most methods the fibers are then stripped apart. Outer bark is then removed from that of the inner by scraping and peeling it away; after which it is then soaked and cooked. Fibers intended for mitsumata paper production is then usually boiled for a couple of hours in a solution of soda ash and beaten to further separate the fibers.

Brief History of Usage
Introduced in the Yedo period (1603-1867) in Japan it believed to have originated in China.. It has also had a long history of use in Nepal and has probably been around for a much longer time than is documented. Today it is harvested and produced in much the same way as it has for centuries and is exported from these countries to the West.

Surface Morphology/ Microscopic Description
Known for its fine-grained, lustrous, soft and pliant fibers.
Glossy thin and smooth paper with distinct chain and laid lines.
The sheet is flexible and lightweight.
Fibers are shorter than kozo fibers and thin and regular in width.
Fibers have fewer markings or nodes than kozo with frequent fine cross striations. The latter sometimes group to form a V shaped pattern.
Some rectangular parenchyma cells often seen.
The walls of the lumen are pronounced and thick.
Cell ends are blunt and roundish.

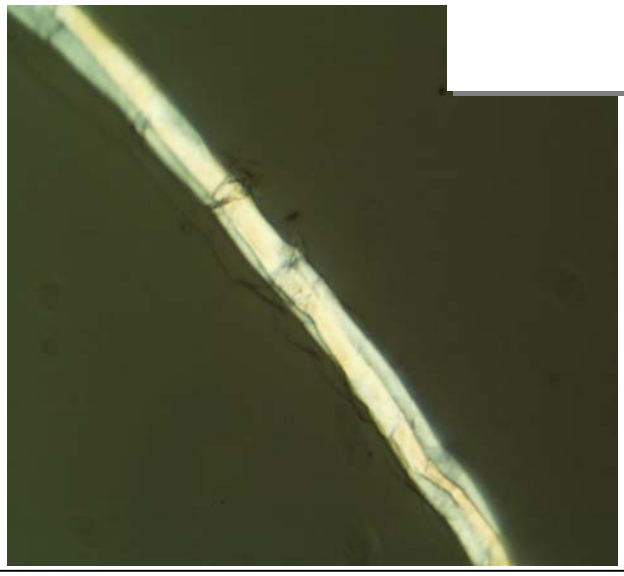
Aging Characteristics
Original paper colour is usually off-white.
The paper has a natural resistance to insects.
With no additives and with traditional manufacture the paper is acid-free.

Technical Examination Techniques/ Chemical Staining Tests
Fibers turn light green/ yellow with the Herzberg stain.

Mulberry

Chemical Formula ***Paper Mulberry,***
from the plant ***Broussonetia papyferious***

Microscopic appearance at x500 mag



Microscopic appearance under slightly crossed polars

Dates of Use
Ancient times to the present day.

Summary of Manufacture
Plant family *Moraceae*
Fiber length is around 10mm.
Plants are harvested in the late autumn after the leaves have fallen.
The fibers of the tree are separated from the inner bark by scraping, soaking and macerating in water. Often they are then further boiled in a weak alkaline solution to rid them of most impurities. After treating they are then rinsed, drained and added to the pulp to make handmade papers. Fibers are often long and unbroken.

Brief History of Usage
Used for centuries from Ancient China as both paper and for clothing. Also prepared by the Polynesians where it was known as 'Tapa' or 'bark paper'. The name is apt for the tougher variety of mulberry grown and harvested there. Attributed possibly to the environmental differences between China and Polynesia, the latter having a much higher annual humidity than the former resulting in faster growth cycles of the plant. Today it is still as well used and harvesting has changed little over the centuries.

Surface Morphology/ Microscopic Description
Fibers vary in length from approximately 6 - 20mm and are long slender and mostly unbroken fibers.
Very long fibers generally with tapered ends, some may appear chopped or blunt.
Incomplete parallel extinction may be seen on wider fibers.
Their width varies slightly but generally is around 0.0030mm.
Most fibers appear almost transparent under the microscope and many show transverse markings or joints as well as longitudinal striae.
The central canal of the fiber is usually obvious and the ends of the fiber are usually rounded and blunt in appearance.

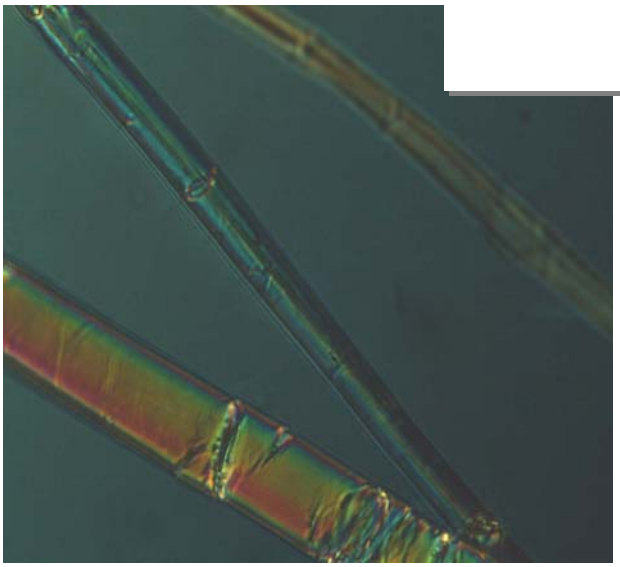
Aging Characteristics
Paper colour can vary dramatically following sheet formation due to the additives to the pulp and also mainly due to the part of the plant from which the fibers came from. White paper usually contains fibers from the inner bark only; white paper with a green tint will probably contain a majority of fibers from between the inner and outer bark ; and tan/buff paper often with flecks of brown may contain fibers from both the inner and outer bark.

Technical Examination Techniques/ Chemical Staining Tests
The herzberg stain will turn fibers red. Note however that cotton, linen, ramie, hemp and manila fibers will also turn a shade of red. Some wood fibers that have undergone partial or mechanical and chemical treatment may also turn red with the herzberg stain.

Tengujou

Chemical Formula
Diplomorpha canescens

Microscopic appearance at x500 mag



Microscopic appearance under slightly crossed polars

Dates of Use

Summary of Manufacture

Brief History of Usage

Surface Morphology/ Microscopic Description

Aging Characteristics

Technical Examination Techniques/ Chemical Staining Tests