

A Glossary of Papermaking Terms by Trisha Garlock

A selection of terms prepared on the occasion of *The International Paper Conference, 1983, Japan*. Supported by a grant from Simpson Paper Company, and first published by World Print Council, San Francisco, California.

The International Paper Conference, 1983, Japan is the seventh in a series of independently organized conferences, such as the World Print Council's 1978 *Paper Art & Technology*, which bring handmade papermakers of the world together in an atmosphere of camaraderie and information exchange. *IPC '83, Japan*, however, is the first such event to be organized outside the United States. It is most appropriate that a conference of this nature and scope be organized in Japan, and in Kyoto in particular, the historical center of *washi*.

The World Print Council thanks the committee and staff of *The International Paper Conference, 1983, Japan*, for all of their planning and hard work in making this conference a reality. A conference of this magnitude has taken a tremendous effort on the part of many people. The World Print Council has been honored to play a small role by helping to secure the participation of the American Speakers and participants, bring the New American Paperworks exhibition to Kyoto, and prepare this accompanying glossary.

Although this glossary is by no means a complete dictionary of papermaking terms, it contains a selection of terms from both East and West, which we hope will help conference participants from throughout the world better understand the various papermaking techniques and exhibited work presented at the conference.

Since there is currently no single accurate information source for handmade paper, this glossary has been the work and collaboration of a number of people. In particular, I thank Tim Barrett, Kathryn and Howard Clark, Don Farnsworth, Ann Asakura Kimura, and Jane Farmer, who all helped clarify the definitions. I am also grateful to Elaine Koretsky and Bernard Toale for their permission to reprint chapters from their book, *International Conference of Hand Papermakers, Boston, Massachusetts, USA, 1980*. I also want to extend my appreciation to our *Printnews* editor, Judith Dunham, for her valuable editorial skills. Last, but certainly not least, I thank Simpson Paper Company, whose generous contribution made this glossary possible. Simpson's continuing support and interest in the dissemination of information about handmade paper should be an inspiration to all those involved in both hand papermaking and the paper industry.

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GLOSSARY

a selection of terms

- ✓ **ABACA**- also called Manila Hemp, is a plant cultivated primarily in the Philippines, as well as in Asia and South America, for rope, textiles and paper. Abaca is not a true hemp, but is related to the banana. The leaf stems provide exceptionally strong and durable fibers that can be used, from either old rope or fibers, to make a very strong paper. *Musa textilis* from the *Musaceae* family.
- AI- Japanese term for indigo. Aizomegami refers to indigo dyed paper, and aizome is the term for indigo dying.
- ALAEA- a red clay used in the decoration of Hawaiian tapa.
- ✓ **ALKALI**- a caustic substance used in cooking plant fibers to remove noncellulose materials such as lignins, gums, waxes and starch. See cooking.
- ALUM**- also called papermaker's alum, is a complex salt, essentially a hydrate of potassium aluminum sulfate. It is used, along with rosin, in the sizing of paper and also with dyes as a mordant for fixing colors. If it is not removed during fiber preparation, its high acidity can cause irreversible damage to paper and works of art.
- ✓ **AMATL**- a pounded mulberry bark paper, similar to tapa, originally made by the Aztecs from varieties of fig trees (*Ficus spp.* from the *Moraceae* family). Amatl is still made by the Otomi Indians of Southern Mexico. See tapa.
- AMPI- the Korean term for gampi. See gampi.
- ✓ **ASP or ASS**- a notched piece of wood attached to the bridge against which the coucher places the mould for a moment to drain. Also called a horn. See bridge and stay.
- ASSAKUKI- a Japanese term for press.
- ✓ **BASHU**- in Japanese papermaking, the stick (traditionally bamboo) used for stirring pulp in the vat.
- ✓ **BAST FIBER**- the category of fiber which comes from the inner bark of numerous shrubs and trees including gampi, mitsumata and kozo. When the inner bark is separated from the dark outer bark and in some cases from the woody cores, it yields long strong fibers that are excellent for papermaking. When fully prepared, inner bark bast fibers usually contain a higher percentage of hemicellulose than seed-hair fibers. The term bast fiber also refers to herbaceous basts such as hemp and flax. See individual fiber headings and hemicelluloses.
- ✓ **BEATERS**- a range of mechanical devices used to macerate and hydrate fibers for papermaking. See Hollander, *naginata*, *teuchi* and *uchikata*.
- ✓ **BEATING**- the fundamental method by which fiber is transformed into refined stock suitable for papermaking. Beating alters the physical form of the fiber by bruising and sometimes cutting. Bruising frays or unravels the fibrils of the fiber, increasing the surface area. It also swells and plasticizes the fibers with water in an action often referred to as hydration. Both effects increase bonding potential in the finished sheet. Each fiber has different beating requirements. Beating must be carefully controlled to obtain desired properties, as beating ultimately determines the quality of paper produced. In Western papermaking, beating is done by machine. In Japanese papermaking, relatively little physical treatment of the fiber is necessary. Beating was traditionally done by hand, but more and more papermakers are using mechanical devices to prepare their fibers. See Hollander, stamper, and *naginata*.
- ✓ **BEDPLATE**- a series of bars or knives beneath the beater roll on a Hollander type beater.
- BLEACHING**- in Western papermaking, a process used to purify and/or whiten pulp usually with a solution of chlorine. This must be carefully controlled as excessive treatment weakens fibers. Although sun bleaching and steam washing have been the traditional bleaching methods for Japanese papermaking, chemical processes are also used today. See kawa-zarashi, tenpi-zarashi and yuki-zarashi.
- BLEEDING**- the migration of ink or color with a sheet of paper.
- ✓ **BONDING**- the inherent ability of cellulose fibers to be drawn to and adhere to one another through hydrogen bonding. Fibrillation, hydration, pressure exerted on the wet sheet and drying are all factors in promoting bonding. See fibrillation, hydration and beating.
- ✓ **BRIDGE**- a plank across the vat on which the coucher rests the mould for the vatman to use in forming the next sheet. See asp and stay.
- ✓ **BRITTLENESS**- the property of paper to crack or fail when bent or embossed. This can be caused by a number of physical or chemical defects including the use of short fibers, overbeating or overexposure to heat.
- BROKE**- damaged or defective paper.
- BUFFERING AGENT**- also termed alkaline reserve, it is an alkaline substance, usually calcium carbonate or magnesium carbonate, occurring naturally in a water supply or purposely added by the papermaker to help protect the paper from exposure to acidity in the environment.
- BULK**- a term used to indicate the volume or thickness of paper in relation to weight.
- ✓ **CALENDERING**- the process of passing paper through a series of rollers to give a smooth or glossy finish to the paper.
- CALIPER**- the thickness of a single sheet of paper usually measured in thousandths of an inch.
- ✓ **CAST PAPER**- a process for making three-dimensional paper art pieces. In the most common method, pulp is poured or patted in or around a mould or form. The pulp is felted together, and the excess water removed through sponging. Once the paper has dried, it is separated from its mould and can function independently as a relief or sculpture. Another method involves the lamination of wet or newly

formed sheets over a mould. Many other variations have also been developed.

✓ CELLULOSE- ($C_6H_{12}O_6$) is a polymer of glucose and the chief component of all natural fibers. It is found in all plants, and occurs (often with other components such as lignins, hemicelluloses, waxes and gums) mainly as long hollow chains called fibers. See fiber.

✓ CHAIN LINES- the more widely spaced watermark lines left on paper made in a laid mould. They are the result of impressions left in the pulp by the chain wires during the papermaking process. Chain wires are twisted around the closely spaced, perpendicular laid wires to keep them in place. The chain lines are usually located directly over the ribs of a mould. See laid lines and laid mould.

CHEMICAL COTTON- purified cotton linter pulp available commercially in various fiber lengths and forms including loose pulp, rolls or cut sheets. Papermakers often refer to chemical cotton as linters. See linters.

✓ CHINA CLAY- a loading agent or filler added to pulp to increase the smoothness and opacity of the paper. Also called Kaolin. See loading and filler.

CHINE COLLÉ- a paper collage process in which sheets or pieces of paper, often too thin and fragile to be used by themselves, are laminated together through the pressure of a press and sometimes paste.

✓ CHIRI- a Japanese term referring to specks of foreign matter. In Japanese papermaking, it refers to bits of black bark or discolored fiber which are usually removed in fiber preparation.

✓ CHIRIGAMI- Japanese paper that contains large amounts of *chiri* or black bark and other foreign matter.

✓ CHIRI-TORI- the Japanese term for the process of removing foreign particles from the papermaking fiber during preparation steps prior to beating and sheetforming.

CLOSE FORMATION- a term referring to a uniform density or distribution of fibers throughout a sheet of paper. Opposite of wild or cloudy.

✓ CLOUDY- a wild or unevenly formed sheet of paper, most apparent when held to the light.

COATED PAPER- a paper surface which has been covered or coated by a substance. The term refers to coating a finished sheet of paper, as differentiated from sizing or loading where materials are mixed in the pulp prior to the papermaking process. Common coating materials are pigments or clays in a solution of starch or gelatin.

✓ COLD-PRESSED (CP)- originally a term loosely applied to loft dried papers. Today, it is a generic term for textured papers. See hot-pressed.

COLLAGE- an artistic technique involving the use of different materials (e.g. papers, string, fabric, found objects) adhered together to create an image.

COLORING- the addition of color to paper. This can be accomplished through the addition of natural or chemical dyes, pigments, paints, colored rags, or a combination thereof, to the pulp. Coloring can take place prior to, during or after beating. Methods of surface coloring include the embedding of colored materials in the sheet, staining the surface of newly couched or dried sheets, and the traditional methods of painting and printing. See dyes, embedding, pigments and staining.

CONTRARIES- a British term for any unwanted or useless specks or foreign particles in raw materials which appear in the pulp or the finished sheet.

✓ COOKING- a process of boiling or steaming raw materials, usually with a strong alkali solution, to remove gums, lignins and other non-cellulose materials from fibers. In Western papermaking, cooking was once performed by the papermaker, but is now primarily handled by commercial mills. In Japanese papermaking, cooking is still usually done by the papermaker. In both processes, the fibers must be carefully washed after cooking to remove the exhausted chemicals and dissolved extraneous matter.

✓ COTTON FIBER- the soft white filaments attached to the seeds of the cotton plant. The long staple fibers, removed by ginning, are used for textiles. Textile industry cuttings provide excellent fibers for papermaking. The short fibers, or linters, which are still attached to the seed after ginning, are removed separately and are also used for papermaking. Cotton is the primary fiber used for Western hand papermaking as it is the purest form of cellulose in nature and thus requires less processing than other fibers. *Gossypium spp.* from the *Malvaceae* family.

✓ COUCHING- the process of removing a newly formed sheet of pulp from the mould surface. In Western papermaking, each sheet of pulp is couched onto a dampened felt. In Japanese papermaking, no felts are used, and each new sheet is couched directly upon the next. See laminating, multiple couch, *nagashizuki* and *tamezuki*.

CUTTING- an optional function of beating employed to reduce the length of the fibers. Cutting is sometimes desirable, sometimes undesirable, depending on the type of paper to be made. Cutting must be carefully controlled for, in general, fibers that are too long tend to clump in a wild formation, and fibers that are too short result in a weak, brittle paper.

DAKAIKI- a Japanese stamper used in lieu of hand beating for preparing bast fibers for papermaking. See stamper.

✓ DECKLE- the feathery edges of a sheet of handmade paper formed naturally during the papermaking process by a small amount of pulp washing between the mould and the deckle. This can be minimized or exaggerated for artistic or other purposes. A torn edge or rough edge in machine made papers is not a true deckle edge.

- ✓ **DRYING**- in Western papermaking, pressed damp sheets were once loft dried (i.e. hung over horsehair ropes or dried flat on canvases in spurs of four to twelve sheets) in the upper stories, or lofts, of mills. Today machines, often with the aid of heat or pressure, are used to dry paper more quickly and flatly. In Japanese papermaking, sheets were traditionally brushed onto wooden boards for drying in the sun. Today, sheets are more commonly brushed onto heated metal plates for indoor drying. See loft drying and *itaboshi*.
- ✓ **DYES**- water soluble coloring agents which usually penetrate and become attached to the fiber. Some types of dyes most frequently used by handpapermakers include: direct dyes- organic dyes usually derived from coal tars; fiber reactive dyes- dyes that form a chemical bond with the fibers; and natural dyes- dyes derived from natural sources such as indigo and onion skins. Since some types of dyes require an acid mordant to set or fix the dye to the fiber, care should be used in the selection of dyes.
- ✓ **EMBEDDING**- the artistic process of incorporating materials or objects such as threads, papers, leaves, twigs or any foreign substance into paper so that the fibers, rather than glue, hold the material in place. There are many methods of embedding objects. In one method, a first sheet is couched, the materials or objects placed on the first sheet, and a second sheet couched over the applied objects. Areas of the paper may also be partially peeled away, revealing the objects underneath.
- EMBOSSING**- a process to create a raised or depressed design in an already formed sheet of paper. Generally, a deeply grooved or built-up plate is used to create an image. Through the pressure of the press, dampened paper is forced into or around the recessed or raised areas of the plate, imparting a relief image in the paper. Embossing may be used without ink (blind embossing or inkless intaglio), over ink, or in combination with ink.
- ✓ **FASTNESS**- resistance to change in color such as fading or bleeding.
- ✓ **FAST PULP**- the term describing pulp of high freeness that drains quickly from the mould. See freeness and slow.
- ✓ **FELT**- in Western papermaking, a heavy blanket (usually woven and usually wool) onto which a newly formed sheet of paper is transferred, or couched, from the mould.
- FELT FINISH**- the surface finish on a sheet of handmade paper left by the impression of the felts during pressing. This is the final finish on the sheet if it is not calendered or externally sized.
- FELT MARK**- the undesirable impression left by worn or uneven felts.
- ✓ **FIBER**- the slender threadlike structures from which papermaking pulp is made. Though synthetic fibers are available today, most fibers used in papermaking are natural fibers and are classified according to the part of the plant from which they are taken, i.e. bast, leaf, seed-hair, trunk. Natural fibers are composed chiefly of cellulose and tend to bond or adhere strongly together after beating and in the presence of water. The degree of bonding is dependent upon the type of fiber used and their proper preparation. See beating.
- ✓ **FIBRILLATION**- the bruising, fraying and alteration of the fiber during beating to increase the number of bonding surfaces between fibers.
- ✓ **FILLER**- nonfibrous insoluble materials, such as clay and calcium carbonate, added to the pulp to fill in the interstices between the fibers in order to improve surface and printing qualities such as opacity, receptivity to ink, and smoothness. Also known as loading.
- ✓ **FINISH**- a general term to describe the surface characteristics of paper or the method of producing them. See calendering, felt finish, hot-pressed, cold-pressed and glazed.
- ✓ **FINISHING**- drying, sizing and/or calendering sheets to complete the manufacture of a particular kind of paper.
- ✓ **FLAX**- a bast fiber plant, cultivated since prehistoric times, which is the source of linen. Pulp for papermaking can be made from either flax fibers or linen rags. *Linum usitatissimum* from the *Linaceae* family.
- ✓ **FORMATION**- also called look-through, refers to the appearance of a sheet of paper when held to the light. Formation may be said to be close, cloudy or wild, and all terms refer to the evenness of fiber distribution in the sheet. Formation is influenced by beating, fiber length, additives and the shake or action of distributing the pulp on the mould. See close formation, cloudy and wild.
- ✓ **FREENESS**- the property of the pulp that describes the rate of water drainage from the newly formed sheet while it is still on the mould. In Western papermaking, it is a measurement of the degree of beating. A lightly beaten pulp drains very quickly and is said to have high freeness. See also fast pulp and slow.
- FUNE**- literally translated, it is the Japanese term for "boat." In Japanese papermaking, it refers to the vat or tub which holds the pulp for the sheetforming process. Also called *sukibune*.
- FURNISH**- the mixture of fiber, water and all other materials such as fillers and dyes from which paper is made. The composition and character of the furnish will determine the kind of paper to be made. See stock and stuff.
- GAMI**- a Japanese suffix meaning paper. The same character can also be read as *kami* or *shi*.
- ✓ **GAMPI**- a shrub that produces one of the three primary bast fibers used in fine Japanese papermaking. It is characterized by fine, tough, glossy fibers and produces a very strong, translucent and lustrous paper. Gampi fibers average three to five millimeters in length. Gampi is nearly impossible to cultivate, and is therefore very precious. *Wikstoemia retusa* or *Diplomorpha sikokiana* from the *Thymelaeaceae* family.

✓ GELATIN- an external sizing made from animal tissue or bone. See sizing.

GLAZE- the gloss or polish of paper, and the process by which it is applied, including various methods such as rolling, pressing and friction.

✓ HAKE- in Japanese papermaking, a drying brush used to smooth sheets on the drying surface.

✓ HALF-STUFF- commercially available cotton rag made from new garment cuttings. Further beating is necessary before it is ready to be made into paper.

HANJI- a Korean term for handmade paper. Literally, *Han* (cold) and *Ji* (paper) referring to the best handmade papers in the cold Korean winters.

✓ HEMICELLULOSES- straight chain polymers of sugar other than glucose found in varying proportions in plants and trees. The chain length of hemicelluloses is shorter than cellulose, and they are less resistant to chemical and atmospheric degradation. Hemicelluloses bond more readily than celluloses and are desirable for some types of papers. Hemicelluloses are found in higher proportions in wood fibers and some bast fibers. See bast fiber.

✓ HEMP- a bast fiber plant, available in many varieties throughout the world, used for making textiles, cordage and paper. Hemp paper was made in China from the second century BC to the tenth century AD, and was the most important papermaking fiber in Japan during the Nara period of the eighth century. Hemp was also an important papermaking fiber in the Middle East and Europe. True hemp, or *Cannabis sativa* from the *Moraceae* family, should not be confused with Manila hemp, more accurately referred to as Abaca.

HIGO- a Japanese term for splints used in the *su*. *Take higo* are bamboo splints, and *kaya higo* are miscanthus splints. See *su*.

HIKIZOME- a Japanese term for "painting dyeing," in which dye is applied to the paper with a brush.

✓ HOG- a slow-moving mechanical agitator used to maintain uniform consistency of pulp in the vat by preventing settling.

HOHOA- the Hawaiian term referring to the rounded club-shaped mallet used in the first stage beating of Hawaiian tapa.

✓ HOLLANDER or HOLLANDER BEATER- a machine, invented in Holland in the late seventeenth century, for beating and refining rags or fibers for papermaking. The pulp is circulated around an oval-shaped vat while passing between metal blades which gradually refine the pulp prior to the sheetforming process.

HO'OLU'U- the Hawaiian term for coloring tapa by dipping into a vat of dye.

HORN- see ass or asp.

HOSHI-ITA- in Japanese papermaking, the term referring to the drying boards.

✓ HOSHO- a Japanese pure kozo paper, normally used for woodcuts.

HOT-PRESSED (HP)- smooth, slightly glossy paper produced by pressing sheets between hot plates or rollers.

HUUN- a pounded bark paper, similar to tapa, used by the Central American Mayans. See tapa.

✓ HYDRATION- the alteration of cellulose fibers during the beating process causing the fibers to swell with water.

I'E KUKU- the Hawaiian term referring to the four-sided mallet, with incised designs used in the second and final stage of beating Hawaiian tapa. The carved designs impart a watermark pattern distinctive to Hawaiian tapa.

✓ INTERNAL SIZING- sizing added before the sheet forming process, either at the beater or to the furnish in a separate mixing step prior to sheetforming. See sizing.

✓ ITABOSHI- in Japanese papermaking, the process of board drying. Board drying has traditionally taken place outdoors in the sunlight to take advantage of the natural bleaching action of the sun (*tenpi-itaboshi*). Vulnerable to weather conditions, the process has led to indoor drying, usually on hot metal plates or boards moved to specially heated rooms (*shitsunai-itaboshi*).

JUMONJI-ZUKI- in Japanese papermaking, the crossweave method of forming a sheet which involves shaking the mould lengthwise and crosswise to entangle the fibers.

JUTE- an Indian plant which became popular for papermaking in Europe in the late eighteenth century when there was a shortage of cotton and linen rags. It is used for sacks, bags and cordage, and a paper can be made from old rope, burlap or clippings. *Corchorus capsularis* from the *Tiliaceae* family.

KAKISHIBU- fermented persimmon juice used to treat sha or shibugami. See *sha* and *shibugami*.

KAMI- a Japanese suffix meaning paper. The same character can also be read as *gami* or *shi*.

KAMISUKI- a Japanese term for papermaking.

✓ KAOLIN- a fine white clay used as a filler. See china clay.

KAPA- the Hawaiian term for bark cloth or tapa. Hawaiian bark cloth is distinguished by its thinness, embossed watermark patterns and a wide range of decorative design and color. See tapa.

KATAZOME- a Japanese term for stencil dyeing.

KAWA-MUKI- in Japanese papermaking, the removing of the dark outer bark with a scraper or knife. See *kurokawa*.

KAWA-ZARASHI- in Japanese papermaking, the washing and bleaching of the bark in a stream or river.

✓ KETA- the hinged wooden frame that holds the removable screen or *su* in a Japanese paper mould. With the *su* in place, the Japanese mould is called a *sugeta*. See *su* and *sugeta*.

✓ KNOTTER- a machine fitted with a slotted plate that is used to remove knots and other impurities from pulp. Plates with different sized slots are used for different types of paper.

KOGATANA- a Japanese term for a knifelike tool used to cut *kozo* and other fibers.

KONNYAKU- the tuberous root of a devil's tongue plant, used to produce a jellylike substance for coating certain kinds of Japanese papers.

✓ KOZO- a general name for a variety of mulberry trees used in Japanese papermaking. The bast fibers of *kozo*, characterized by strong, long and sinewy fibers, produces a very strong and dimensionally stable paper. *Kozo* fiber is the longest of the Japanese fibers, and averages ten millimeters in length. It can be cultivated, and accounts for ninety percent of the bast fiber used for hand papermaking in Japan today.

Broussonetia papyrifera from the *Moraceae* family.

KUA- the Hawaiian term for the wooden anvil, usually six feet long, on which *tapa* is beaten.

KUKUI- the Hawaiian term for candlenut (*Aleurites moluccana*) which is used for making dyes for *tapa*.

KUMIKOMI- in Japanese papermaking, the term referring to all three bark layers of Japanese bast fiber trees after its removed from the woody core. *Kurokawa* also refers to the flaky black outer layer of bark which is usually removed prior to papermaking, leaving a thin green middle layer and the white inner bark. Often the green layer is removed as well, leaving only the white inner bark. The black bark is either discarded or made into *chirigami* (wastepaper). See *chirigami*.

KUROSUKASHI- Japanese shadowmark.

KUSAKIZOME- a Japanese term referring to natural plant dyeing.

✓ LACE PAPER- a Japanese paper made by placing a stretched stencil a few millimeters above a newly formed sheet of wet pulp and then spraying or sprinkling water through the stencil, displacing areas of the pulp and creating a lace-like effect. See *mizutamashi*.

✓ LAID LINES- The closely spaced linear impressions left on paper made in a laid mould. The impressions are the result of the pulp being thinned in a natural watermarking process by the wires which support the pulp during the sheetforming process. See chain lines and laid mould.

✓ LAID MOULD- a mould in which the screen or sieve area is constructed of closely spaced wires or bamboo strips laid parallel to each other and held in place by more widely spaced, perpendicular chain wires or threads which are twisted around each closely spaced laid wire. Paper made in a laid mould is called laid paper.

✓ LAMINATING- the process of combining layers of paper by pasting one or more sheets of paper, or couching one or more layers of wet pulp, on top of each other. In the latter process, also called multiple couch, the fibers of each layer bond during the drying process, creating a single sheet or work of art.

LAYER- one of the principle participants in the Western papermaking process. After the first pressing, the layer removes interleaving felts from the post and restacks the sheets without felts for additional pressing. The layer will restack and press the sheets until the desired dryness and finish is achieved. See *vatman* and *coucher*.

✓ LIGNINS- nonfibrous polymers that bind cellulose fibers together in living plants. Cellulose, hemicellulose and lignins are found in all plants, but their proportions vary greatly. Lignins reject water and resist bonding, and are therefore removed to the greatest extent possible in papermaking.

✓ LINTERS- the short cotton fibers that remain on the cotton seed after the first ginning. They are too short for textile use, but are used in papermaking. See *chemical cotton* and *cotton fiber*.

LOADING- the addition of substances, usually clays or minerals, to the pulp to fill in the interstices between the fibers and thus improve specific printing qualities such as opacity, receptivity to ink and smoothness. Also known as *filling*.

✓ LOFT DRYING- the method of air-drying handmade paper by hanging the wet sheets over horsehair ropes or on flat canvas drying trays. Loft drying was given its name as it often took place in the upper stories or lofts of mills.

✓ MACERATE- the process of beating Western fibers to bruise, tear and separate individual fibers either by hand or machine to prepare them for sheetforming. See *beating*.

MARBLED PAPER- a decorative paper, used primarily in bookbinding, which carries a variegated marble pattern. Marbled papers are most often made by floating oil or water based pigments on water or a special solution, combing the or swirling the pigments to create a pattern, then laying paper on the surface to pick up the pigments.

MASE- in Japanese papermaking, a hand-operated agitator shaped like a giant comb, used for mixing the pulp in the vat.

✓ MITSUMATA- one of three primary sources of bast fibers for Japanese papermaking, it is characterized by soft, absorbent, and slightly lustrous fibers and produces a paper with a very smooth surface, more lustrous than *kozo*, but not as lustrous as *gampi*. Like *gampi*, *mitsumata* fibers average three to five millimeters in length. *Edgeworthia papyrifera* from the *Thymelaeaceae* family.

MIZUTAMASHI- Japanese "water drop paper" created by spraying or sprinkling water through a stencil or directly on a freshly formed sheet. See lace paper.

MORDANT- in dyeing, a chemical substance used to fix and/or change colors applied to the fibers.

MOTASE- in Japanese papermaking, the term that refers to making the main thickness (i.e. the repeated dippings and sloshings used to build up a sheet of paper during *nagashizuki* sheetforming). See *kumikomi*, *sutemizu* and *nagashizuki*.

MOULD or MOLD- the basic piece of equipment used for sheetforming. In Western papermaking, it is a wooden or other frame over which a porous screen or cloth is stretched. A second, removable frame or deckle fits exactly over the edges of the screen, and acts as a rim to control the size of the sheet. In Japanese papermaking, the porous mould surface or *su* is made out of bamboo strips woven together with silk threads, and is removable from its frame. In both processes, the mould is dipped in the pulp, and the screen acts as a sieve, allowing the water to drain and leaving a mat of fibers on the screen. See laid mould, wove mould, deckle, *su*, *keta* and *sugeta*.

MOULD-MADE PAPER- refers to paper made on a cylinder machine to look like handmade paper. The term mould-made is actually a misnomer since it is formed continuously on a mesh cylinder, and handmade paper is formed on a mould.

MULTIPLE-COUCH- the couching or laminating of one or more sheets of wet pulp on top of each other. The fibers of the wet sheets will bond during the drying process, creating a single sheet or work of art. See couching and laminating.

MYOBAN- a Japanese term for alum. See alum.

NAGASHIZUKI- the Japanese term to describe the hand papermaking process employing long, lightly beaten bast fibers and a viscous formation aid called *neri*. During the formation of a typical *nagashizuki* sheet, the papermaker dips his mould into the vat, picks up a charge of the vat mixture and immediately sends it across the surface and off the far side of the mould. He makes several additional dips into the vat, each time sloshing the mixture back and forth and from side to side with any excess ejected off the far side of the mould. The process is repeated until the desired thickness is achieved. (During sheetforming, the *neri* helps to disperse the long bast fibers and control the drainage rate.) To couch the sheet, the flexible screen or *su* is removed from the mould and lowered face down onto a pile of previously couched sheets. The *su* is then carefully peeled away, leaving the new sheet smooth and unwrinkled atop a pile of previously couched sheets. No felts are used in the *nagashizuki* process.

NAGINATA- a specialized Japanese machine that prepares stamped bast fibers for sheetforming by effectively teasing them apart. It is similar to a Hollander, but with scythelike blades instead of a roll.

NAZEKAWA- in Japanese papermaking, a term referring to the white inner bark with the green middle bark layer still attached. See *kurokawa* and *shirokawa*.

NENDO- clays used as coloring or loading agents in Japanese papermaking.

NERI- in Japanese papermaking, a viscous formation aid, derived from the roots or bark of various plants, which is added to the papermaking solution to control the drainage rate and aid in dispersion of the fibers. *Neri* is usually produced from the roots of the *tororo-aoi*, a variety of hibiscus. See *tororo-aoi*.

NIHO'OKI- the Hawaiian term for a shark's tooth cutting tool used to strip the bark of the *Wauke* plant for tapa making. It is also used to trim the finished tapa.

NIKAWA- in Japanese papermaking, a gelatin used in sizing.

'OHE KAPALA- the Hawaiian term for the bamboo stamp printing tools used to decorate tapa.

OLENA- the Hawaiian term for turmeric (*Curcuma longa*), used for making dyes and scenting tapa.

PACK- a pile of damp sheets of paper, after pressing and after the interleaving felts have been removed. See parting.

PALA'A- the Hawaiian term for lace fern (*Sphenomeris chinensis*) which are used to make dyes for tapa.

PAPYRUS- the quasi-paper made by placing two layers of thinly sliced stalks of the papyrus plant (*Cyperus papyrus* from the family *Cyperaceae*) at right angles and pressing, thus laminating the layers to create a flexible writing surface. The process was developed by the Egyptians over 4,000 years ago. This is not considered a true paper.

PARCHMENT- a writing surface made from the scraped and treated hides of animals, especially sheep, goats and calves, which was developed by the Persians as an alternative to papyrus. Parchment was more durable and flexible than papyrus and could be folded into a book form.

PARTING- the separation of the damp sheets of freshly made paper from the felts after the pack comes from the press. The pack may be pressed, reparted, restacked and repressed until the desired state of surface finish and dryness is attained. See layer.

pH- a logarithmic measure of acidity on a scale of zero to fourteen. A pH of seven is neutral. Below seven is acid, above seven is alkaline.

PIGMENTS- insoluble coloring agents comprised of finely ground particles which either coat the fiber or become entrapped in the fibrils like fillers. Pigments are generally the most light fast coloring agents. See fillers and fastness.

PILCHER- a thickness of three or four felts sewn together and placed on top of a newly formed post before pressing.

- PITAK- the Korean term for black bark. See *Kurokawa*.
- ✓ POST- a term referring to a pile of freshly couched sheets of pulp, alternated with felts, which is ready for pressing. A post may vary in size and number of sheets.
- ✓ PRESSING- the process of squeezing the water from a sheet or post to increase bonding, hasten the drying time and sometimes impart a special finish to the sheet(s). Pressing may be done by a variety of methods and machines including a hydraulic or mechanical press, a vacuum table, boards and weights, and any number of other inventions.
- ✓ PULP- the aqueous substance containing the refined fibrous material from which paper is made. See stock, stuff and furnish.
- QUIRE- an antique measurement for 1/20 of a ream or twenty-four or twenty-five sheets. See ream.
- ✓ RAG CONTENT- a term referring to the proportion of cotton cloth fiber (new or old) relative to other materials in a particular paper, i.e. 100% rag. Rag content should not be confused with cotton fiber content which may refer to cotton linter fiber. See half-stuff.
- RAMIE- a bast fiber plant in the nettle family, also called China grass, which is native to Southeast Asia. Ramie is widely grown in China, and is used for making paper as well as cloth for the sieve portion of the mould. It yields long, silky and durable fibers which are difficult to extract, but can be used for paper, fabric and cordage. *Boehmeria nivea* from the *Urticaceae* family.
- REAM- a measurement for paper generally twenty quires or 480 sheets. The number varies according to the type and size of paper, and the customs of a given country. In the United States, a ream is generally 500 sheets.
- RETREE- a term used to refer to slightly defective sheets of handmade paper.
- ✓ RETTING- the partial preparation of fibers or rags through fermentation which, when properly controlled, will begin to loosen and separate the fibers without undue harm to the cellulose.
- ROSIN- an internal sizing agent for paper derived from distillation of turpentine from the gums of coniferous trees. When alum is used with rosin in the paper sizing process, the sizing becomes acid in nature and causes deterioration to paper and works of art. See sizing.
- SAMIJITAK- the Korean word for mitsumata. See mitsumata.
- SEED-HAIR FIBER- fiber that is attached to the seed of a plant. See cotton fiber.
- SEIROMUSHI- in Japanese papermaking, the process of steaming branches to soften the bark for stripping. The process is used for kozo and mitsumata, but not for gampi, which must be stripped at the harvesting site when freshly cut.
- ✓ SHA- a woven silk gauze, coated with persimmon juice, which is placed over the su in Japanese papermaking to impart a wove pattern to the sheet or to hold a watermark. Synthetic meshes are also used today. See wove mould.
- ✓ SHADOWMARKS- a term applied to a watermark that, when held to the light, appears three-dimensional, as the design is both lighter and darker than the paper itself, as opposed to line watermarks, which appear only lighter. It is also referred to as a chiaroscuro watermark. See watermark and *kurosukashi*.
- SHAJIKU- the Japanese papermaking term for cooking.
- ✓ SHAKE- also called vatman's stroke, it is the movement given to the mould by the vatman to distribute the fibers evenly over the mould.
- SHI- a Japanese suffix for paper, i.e., *gampi-shi*. The same character may also be read *kami* or *gami*.
- SHIBORIZOMEGAMI- Japanese "tie-dyed paper" where areas of the paper are gathered around small sticks and are tied or wrapped with strings. The tied sheets are immersed in dye and hung to dry. A tie pattern is left when the strings are removed.
- SHIBUGAMI- Japanese paper treated with persimmon juice to waterproof and strengthen the paper.
- SHIFU- Japanese woven cloth made of paper.
- SHIROKAWA- in Japanese papermaking, the white inner bark which is left after the green middle layer, *nazekawa*, and dark outer bark, *kurokawa*, are removed. Shirokawa is used to make the lightest color traditional papers. See *nazekawa* and *kurokawa*.
- ✓ SHITO- in Japanese papermaking, a pile of wet sheets of newly formed paper.
- SHITODAI- in Japanese papermaking, the couching board and stand onto which freshly made sheets are accumulated. *
- SISAL- second to Abaca in strength, it is an important cordage fiber from the leaf of the sisal hemp plant, and is also used for making paper. *Agave sisalana* from the *Agavaceae* family.
- ✓ SIZING- a process by which an agent is added to paper to make it more impervious to ink or moisture and eliminate ink feathering and bleed through, usually by aqueous substances. Sizing added before the sheetforming process, either in the beater or in the vat, is known as internal, stock or beater sizing. Sizing added after the sheet is formed is called surface, tub or external sizing. Some of the most common internal sizes are alum and rosin (highly acid), and alkylketene dimer (neutral to alkaline). Common external sizes are potato and corn starch, and until recently, gelatin. The various materials used in sizing are referred to as sizing agents.

✓ SLOW- a term describing a pulp of low freeness that drains slowly from the mould. See fast pulp and freeness.

✓ SLURRY- prepared pulp, water and other materials (i.e. fillers and pigments) in the proper mixture and suspension for sheet forming. See furnish, stock and stuff.

STAINING- the surface application of color to a newly couched or dried sheet.

✓ STAMPER- a water-, animal-, or wind-powered machine developed in Southern Europe in the thirteenth century, which reduced rags and other materials to pulp through the use of large trip hammers working in a mortarlike trough. The stamper was the major piece of fiber preparation equipment used in European mills until the invention of the Hollander in the late seventeenth century. In Japanese papermaking, a much lighter weight stamper is still sometimes used in the preparation of bast fibers. See dakaiki.

STAY- a platform, perpendicular to the bridge and level with the top of the vat, where the vatman places his mould after the sheet has been formed and before it has been couched.

STOCK- a term referring to papermaking materials in all its stages from rags and fibers to finished stuff.

✓ STUFF- prepared pulp which is ready for sheetforming. It may be referred to as half-stuff before it has been completely beaten. See half-stuff, stock and furnish.

✓ SU- the removable, flexible surface of a Japanese papermaking mould. It is usually made of very thin bamboo strips which are woven together with specially prepared silk threads.

SUBUSE- in Japanese papermaking, a wet sheet couched on a board to dry without pressing.

✓ SUGETA- the Japanese papermaking mould comprised of both the su (screen) and the *keta* (frame).

SUKASHI- the Japanese term for watermark. See watermark and *kurosukashi*.

SUKIBA- the Japanese term for the papermaker's workshop or work area.

SUKIBUNE- the term for vat in Japanese papermaking. See *fune*.

SUKIIRE-GAMI- Japanese paper with embedded leaves, flowers, insects, etc.

SUKIZOME- a Japanese paper dyeing technique in which the fibers are dyed before they are made into paper.

✓ SUMINAGASHI- a Japanese marbling technique, created by forming concentric ripples of ink on a surface of water, manipulating the pattern and laying a single sheet of paper on the surface to absorb the pattern. See marbling.

✓ SURFACE SIZING- also called tub sizing, it is sizing applied to the dried sheet and is usually composed of starch or gelatin. See sizing.

SUTEMIZU- in Japanese papermaking, to cast off or eject the excess pulp solution.

TAK- the Korean term for paper mulberry. See *kozo*.

TAKPUL- the Korean term for the viscous formation aid. See *neri*.

TAMEZUKI- the Japanese term to describe Western sheetforming, where in one continuous motion the papermaker dips the mould and deckle into the slurry and brings it up in one smooth movement. The papermaker then shakes the mould slightly from side to side and front to back to distribute the fibers evenly as the water passes through the porous screen of the mould. The deckle is removed, and the sheet is couched onto a dampened felt.

✓ TAPA- a Polynesian pounded bark paper or cloth made from the inner bark of a variety of plants, most commonly of the mulberry family, which includes the Japanese *Kozo*. Tapa is widely known as Hawaiian bark cloth. Various forms of tapa were used throughout the Pacific Basin, Central and South America, the Northwestern United States, West Africa, China and Japan. See *kapa*, *amatl* and *huun*.

TENGUJO- an extremely thin *kozo* paper.

TENPI-ZARASHI- in Japanese papermaking, the term for sun bleaching.

✓ TENSILE STRENGTH- the ability of a paper to withstand breaking when a strip of specified width is pulled apart by a standard testing device.

TEUCHI- in Japanese papermaking, the term for hand beaten or hand beating. See *uchikata*.

TEXTURE- in papermaking, it refers to the surface or feel of a sheet of paper.

TOBIKUMOGAMI- Japanese "flying cloud paper" characterized by a pattern of dyed *gampi* fibers distributed across the sheet.

✓ TORORO-AOI- the Japanese name for a plant whose roots are used to make *neri*. *Abelmoschus manihot* from the *Malvaceae* family. See *neri*.

TREBLES- also called treble lines or drying lines, were loosely woven ropes made of horsehair or other materials that did not stain the paper, over which sheets of paper were hung to dry in the lofts of old European mills. See loft drying.

TSUKEZOME- a Japanese dyeing technique in which a formed sheet of paper is immersed in liquid dye. The sheet is usually dried, and the dipping procedure repeated to build up the color.

TSURI- in Japanese papermaking, the overhead suspension system of flexible bamboo poles and cords which help support the mould during sheetforming.

UCHIGUMOSHI- Japanese "hanging cloud paper" made by various methods including dipping the edge edges of a sheet of paper into a vat of dye or dyed gampi fibers causing an irregular pattern of color to flow over the edge(s) of the sheet.

UCHIKATA- in Japanese papermaking, the method of hand beating the fibers. See *teuchi*.

UNRYUSHI- Japanese "cloud dragon paper" characterized by strands of unbeaten kozo fibers scattered throughout the paper.

USUYO-SHI- in Japanese papermaking, a term referring to thin paper.

VACUUM FORMING- a process for forming flat, collaged and bas-relief paper pieces. A sheet of pulp is couched or pulp is poured onto a vacuum table, often over or into a relief form or mould. The table is covered with a plastic sheet, and a compressor draws the air and water from the area, creating a vacuum which sucks the pulp around or into the mould or form. This process also presses the fibers into closer proximity, which helps to bond the fibers in much the same way as a press is used for flat sheets. The process removes a major part of the water from the pulp and leaves it in the shape of the mould.

VAT- the tub which contains the prepared pulp for the papermaking process.

VATMAN OR VAT PERSON- the person who forms the sheet of paper by dipping, lifting and shaking the mould to distribute the fibers.

VELLUM- a fine grade of parchment prepared from the skin of calf or kid. The term was applied to any parchment used in manuscripts during the Middle Ages. See *parchment*.

WAI HO'OLU'U- the Hawaiian term for the dipping liquid used to dye *tapa*.

WASHI- the Japanese term for handmade paper.

WATERLEAF- unsized paper, generally very absorbent.

WATERMARK- the more translucent area(s) of a sheet of paper which are especially visible when held to the light. These areas are the result of the impressions left in the pulp by fine wire or metal relief designs which are sewn to the mould surface. When the sheet is formed on the mould, the pulp settles in a thinner layer over the wire design since the design is in relief. The design area is thinner and thus more translucent when held to the light. Watermarks are primarily used today as logos or trademarks to identify a paper, papermaker, artist or mill.

WAUKE- the Hawaiian term for paper mulberry, which is the source of bast fiber for *tapa* making. *Broussonetia papyrifera* from the *Moraceae* family. See *kozo*.

WILD- a term which refers to the uneven distribution or clumping of fibers in a sheet of paper. The opposite of a close formation. See *close formation* and *cloudy*.

WOVE MOULD- refers to any mould with a woven mesh surface. In Western papermaking, the surface is usually a bronze mesh. In Japanese papermaking, it is usually a specially treated silk gauze placed over the *su*. Paper made on a wove mould is called *wove paper*, and is distinguished by a regular appearance when held to the light, rather than the ribbed appearance of *laid paper*. See *laid mould*, and *sha*.

YUKI-ZARASHI- in Japanese papermaking, a term referring to snow bleaching of bark or paper.