

HAND PAPERMAKING

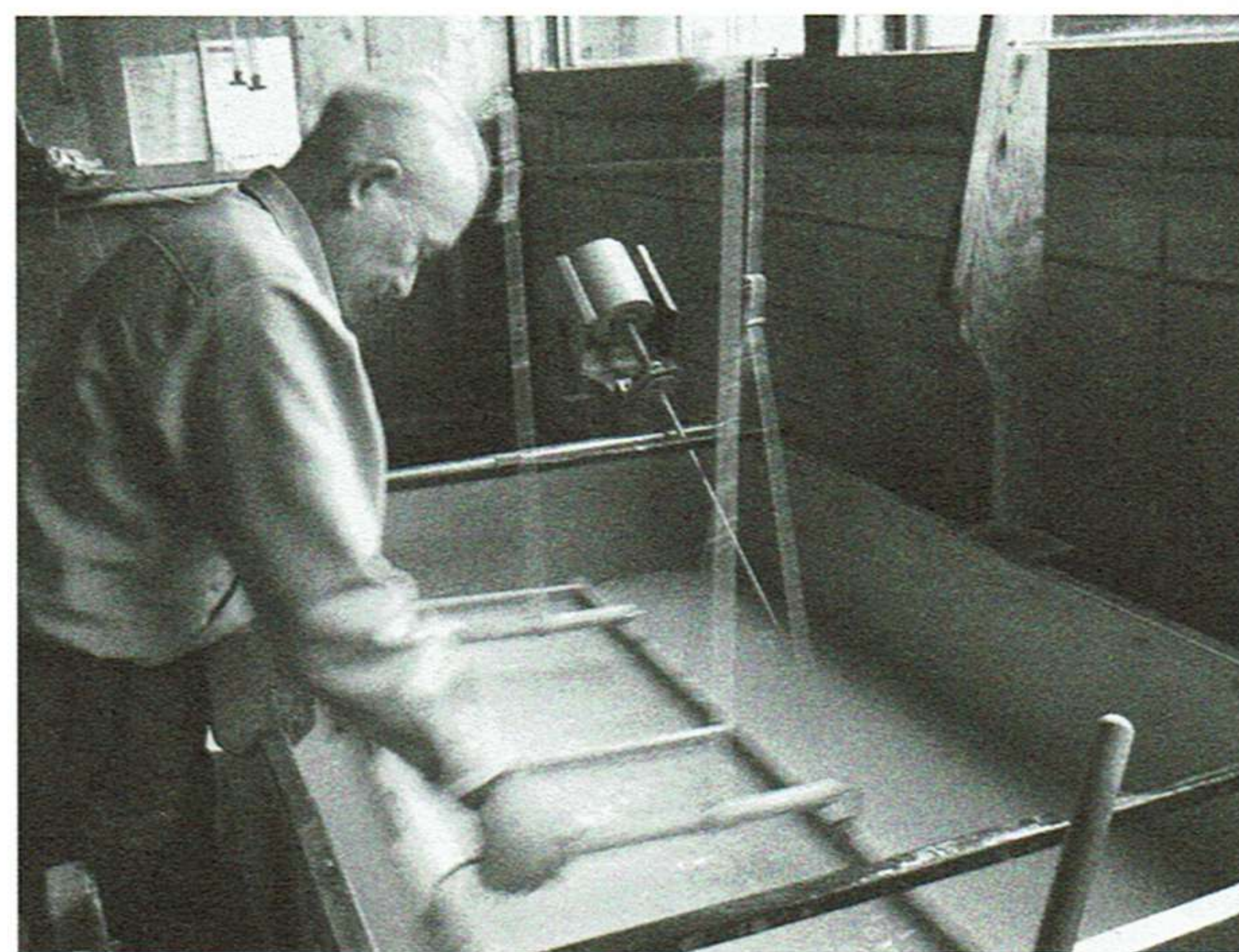
The background of the cover is an abstract composition of vertical bands. From left to right, there is a narrow green band, a wide tan band, a narrow dark brown band, and a wide light brown band. The tan and light brown bands have a mottled, textured appearance, while the other bands are more solid in color.

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Two-page spread showing the beating step in the papermaking process, from *Kamisuki Chohoki* [A Handy Guide to Papermaking], originally published in 1798. All photos by and courtesy of the author unless otherwise noted.



Living National Treasure papermaker Iwano Ichibei making Hosho paper in Echizen, Fukui prefecture. 2006. Photo by and courtesy of Mina Takahashi.

Observing Variations in Japanese Papermaking Traditions, Tools, and Techniques

PAUL DENHOED

When first introduced to the basic techniques of Japanese papermaking, I knew immediately that I wanted to learn more. Some fifteen years later, I realize that even a lifetime's devotion may not be enough to fully understand the subtleties of the varieties of Japanese paper.

Most of us have a set of pictures in our minds, outlining the basic process of Japanese papermaking. It has been explained to us. We have read about it. However, the strikingly diverse ways in which the steps are executed are perhaps less well understood. This variety can be attributed in part to locale. Regional differences in climate, water source, fiber characteristics, tool production, and local tradition, all contribute to nuanced variations in techniques and the resulting papers. Moreover, throughout history the Japanese have cultivated a vast range of handmade papers for an unimaginable array of applications. In many cases, Japanese papers are the result of the determined development of a specific combination of technique, materials, and tools—all impacted by local conditions—in order to make a product that is uniquely suited to a particular use.

For as long as I have been studying washi in Japan, I have endeavored to visit studios located throughout the country. I am grateful to have witnessed firsthand some of the different techniques that are employed from region to region. After five years, and about thirty studios, I feel as if I have only just begun my research. Perhaps with any craft, the spectrum of tools and techniques broadens with investigation, but the closer I look at Japanese papermaking, the richer, more interesting, and infinite the possibilities seem to be. In this brief article, I would like to share some of my findings about the diversity of production methods.¹ My hope is to enable readers of *Hand Papermaking* to make better, well-informed decisions when obtaining and using Japanese papers, and to help hand papermakers identify appropriate production methods when preparing Japanese-style papers for specific uses.

In this article I have divided the Japanese papermaking process into eight main steps, and focused on methods used for paper made entirely or chiefly from kozo fiber.² Kozo paper represents about 80% of handmade washi. By utilizing the other two main plants, mitsumata and gampi, or other fibers occasionally used in Japan, even further variation is possible in the finished paper.



Worker in the kozo field at harvest time, Oguni village. Courtesy of Imai Hiroaki.



Detail of the green layer being removed from kozo bark, Oguni Washi Papermaking Studio. Courtesy of Imai Hiroaki.



Fukunishi Hiroyuki rinsing kozo in the Yoshino river in preparation for kawazarashi (river-bleaching), a process which whitens the fiber by exposing it to the sun and the rinsing power of the river. 2006. Photo by and courtesy of Mina Takahashi.

1. Selecting the Fiber

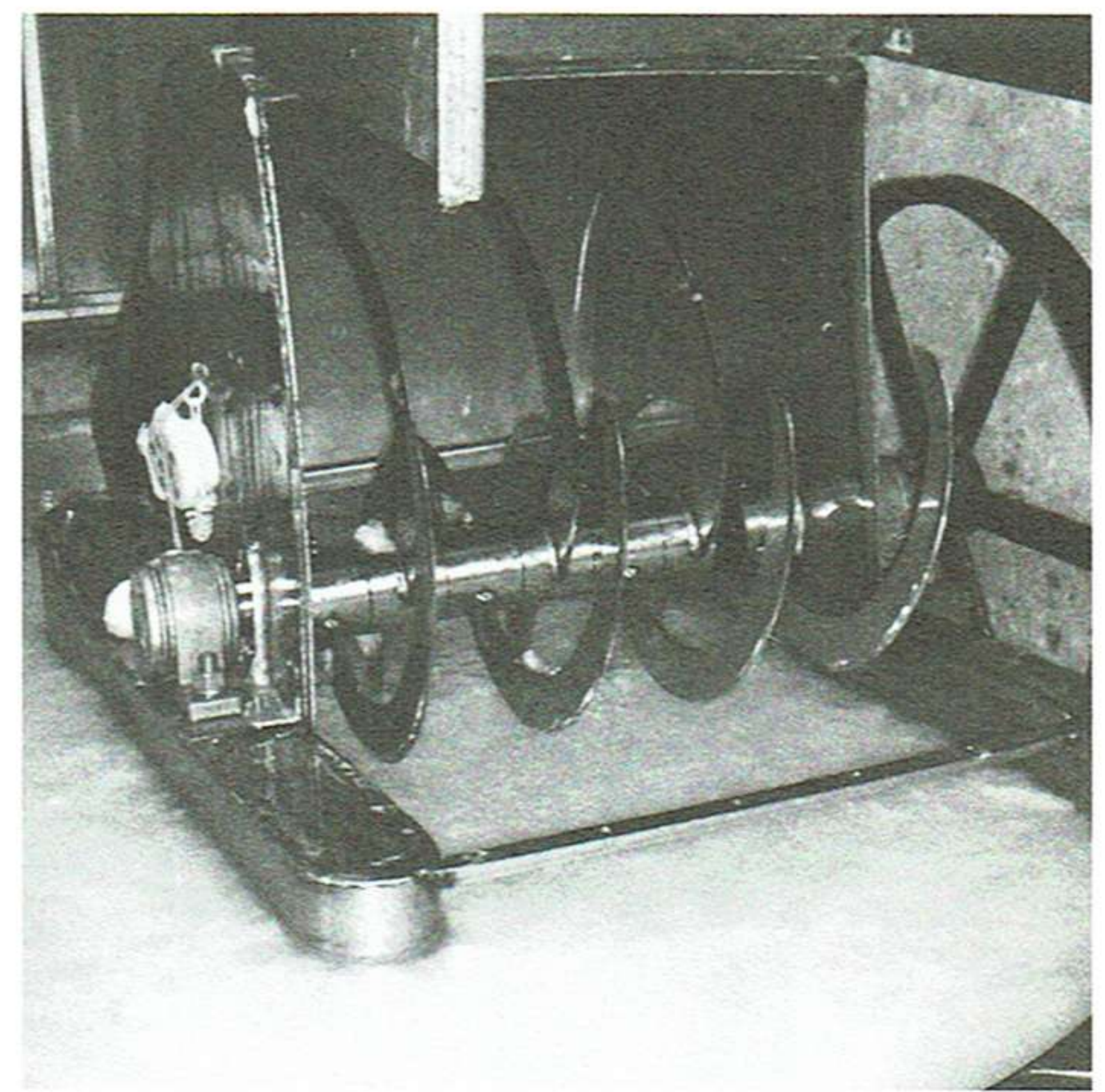
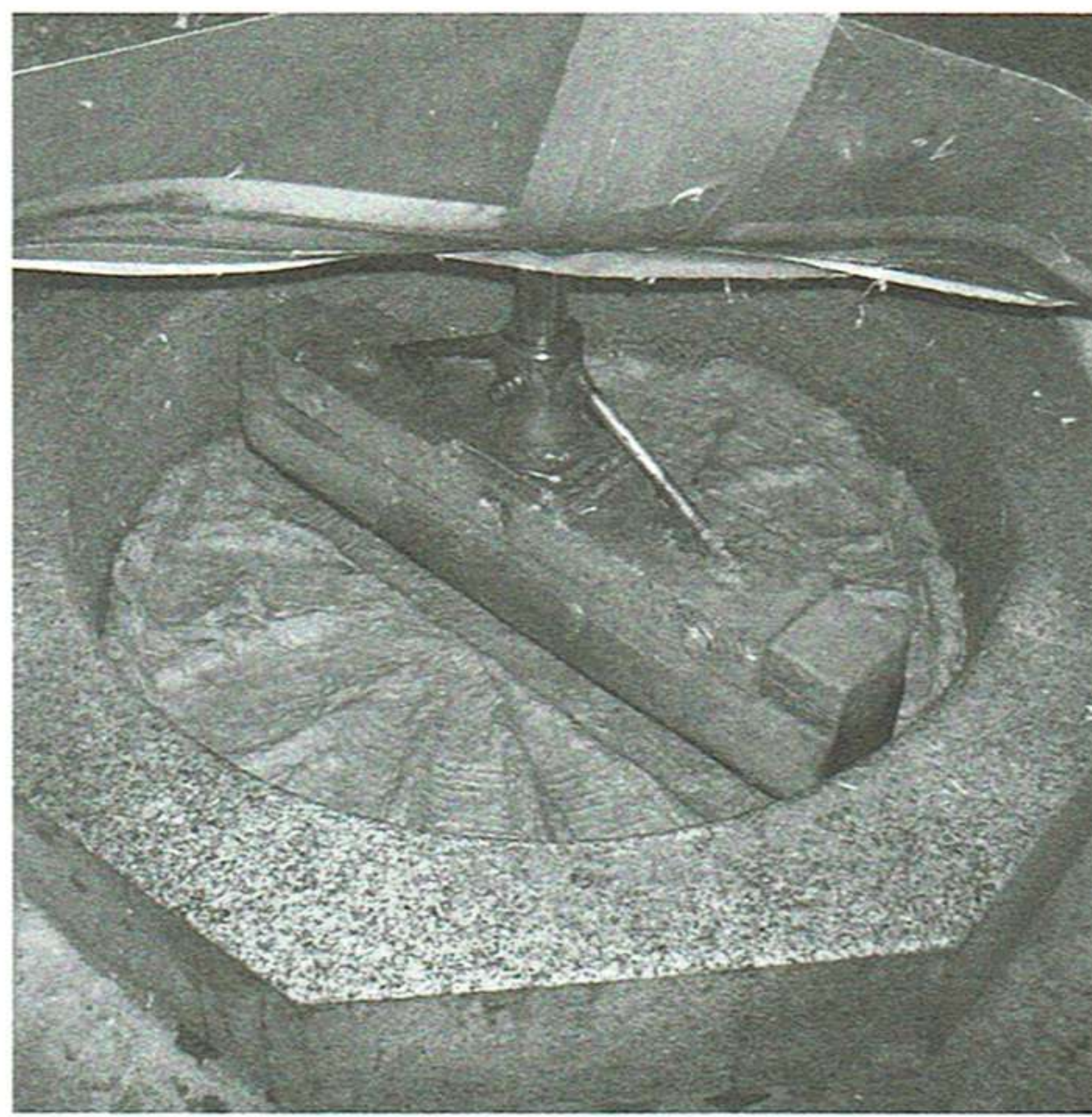
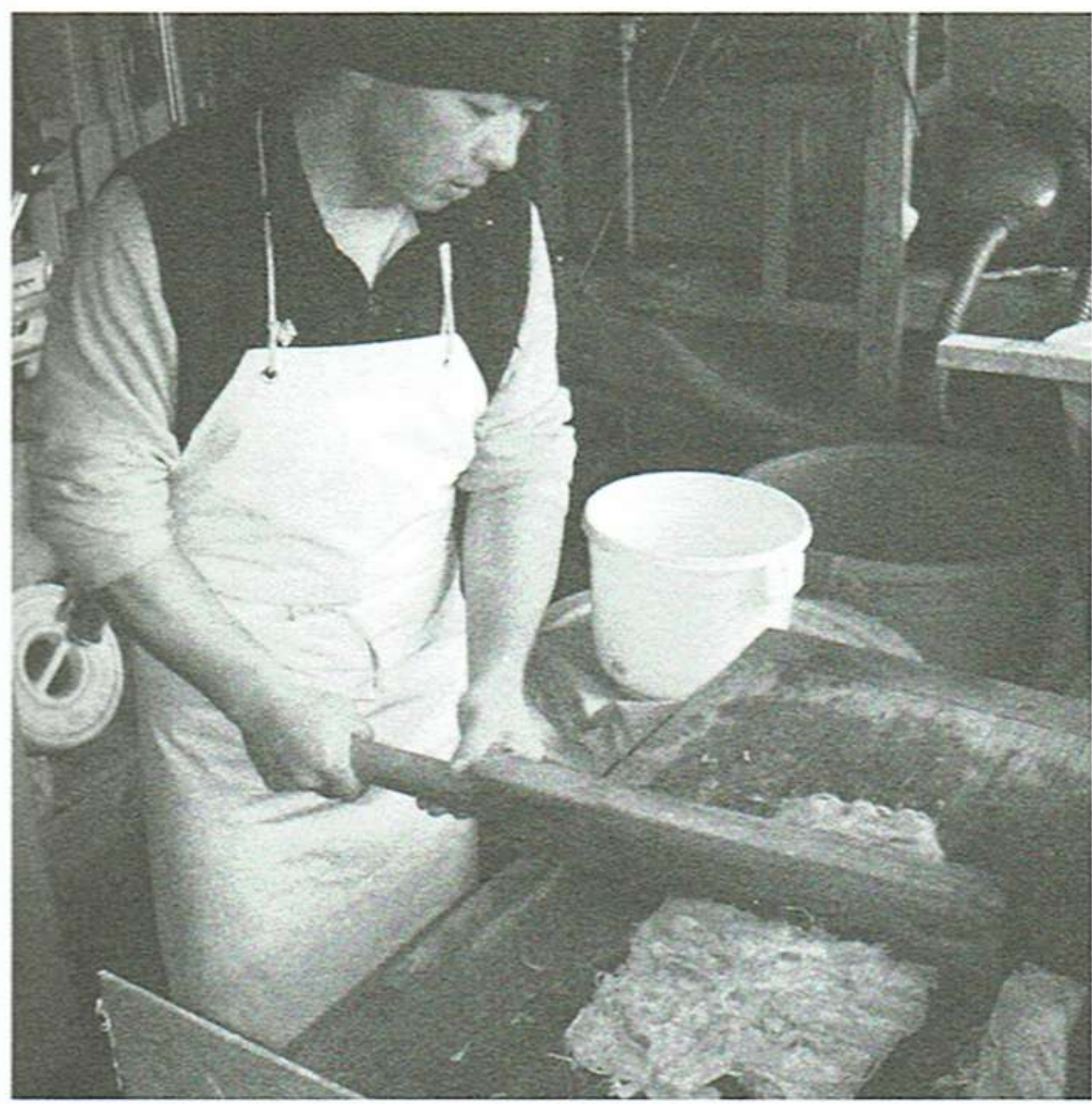
As we are limiting our discussion to kozo paper, fiber selection would seem straightforward. However, there are at least four botanical varieties of kozo.³ And within each type, there can be wide variation in fiber characteristics depending on the location, climate, and growing conditions. Many papermakers suggest that they are able to make *their* paper only as a direct result of cultivating their own kozo crop, bringing forth the unique characteristics of their locally grown kozo. Others describe the difficulty of continuing to make *their* paper, as the quality of the fiber they are receiving from suppliers continues to deteriorate or change. One papermaker who was forced to switch to a new supplier in a different region a few years ago, concedes that the paper he makes now is subtly different from what has been made in his family's studio for generations. Changes in fiber stock invisible to the naked eye will become apparent when the paper is put to use. With this in mind, fiber blends have been developed to make paper that is softer, or more porous, or denser, or perhaps simply less expensive. Although originally a 100% gampi paper, Torinoko (a popular paper for Japanese-style painting) is now available in a variety of blends (e.g., 100% gampi, a mixture of mitsumata and gampi, or 100% mitsumata).⁴ These differences in percentages may seem trifling, but Living National Treasure papermaker Iwano Ichibei once told me that a well-known Japanese printmaker had continually asked him to offer a version of his world-renowned Hosho paper by adding as little as 5% wood pulp, to fill in the spaces between the kozo fibers and make the paper more "printable." Iwano refused; he makes only papers of 100% kozo.

2. Scraping

After the kozo shoots are harvested, and the bark is stripped from the woody pith, its black outer layer is usually scraped off. The middle green layer is often removed too, but sometimes left intact. There are varieties of paper (such as Sekishubanshi) that are well-known for qualities attributed to the inclusion of the green layer. This practice leads to a crisper, more yellow sheet, said to be insect resistant. In one studio I visited, they endeavor to remove only the *top half* of this thin green layer, leaving behind only the softer, more yellow portion. For some papers, it is necessary to remove every trace of discolored, hardened, or otherwise imperfect fiber during the scraping process. When preparing fiber for Udagami, papermakers in Yoshino trim 1 to 5 cm from both ends of the bark strips (where discoloration tends to occur). If left in, these dark fibers would add an overall shade to the finished sheets. The trimmings are collected, and used later to make a different, inferior grade of paper. After the scraping process, the bark may be whitened naturally by exposing it to sun, snow, or cold.

3. Cooking

The most common agent today for cooking fiber in Japan is soda ash.⁵ It is a snap to use and relatively gentle on the fiber. But it is not the only choice, and the selection of alkali has a great effect on the finished paper.⁶ Caustic soda is a potent chemical that will remove the outer black layer during cooking. While it allows the papermaker to skip the tedious and time-consuming step of scraping, it can damage the cellulose. Both caustic soda and soda ash tend to leave behind traces of sodium, considered detrimental to the strength and longevity of the paper. Cooking with lye of wood ash is the traditional method, and tends to be gentle on



Fiber may be beaten by hand (left), in a stamper-type beater (center), or in a naginata beater (right).

the cellulose. It is widely respected as the appropriate choice for warm, natural, long-lasting papers. The term “wood ash” is generically used to refer to ashes made from burning a wide variety of plant material, including various hardwoods, but also plants (or waste from plants) such as rice straw, buckwheat husk, and mugwort. Historically it was well known that the quality of the finished paper would change depending on what material was burned to make the lye. For example, lye made specifically from taro stem ash was said to produce a luster in the finished sheets unattainable with other ashes.⁷ The use of wood ash as an alkali is rare in contemporary Japanese papermaking, reserved for the most traditional production, and the distinction between lyes of different plant ashes is no longer common knowledge. One disadvantage of using wood ash is that it can leave behind traces of potassium, also detrimental to strength and longevity. Lime, on the other hand, leaves behind trace amounts of calcium carbonate, which can act as a buffering agent. From a conservation standpoint, lime may be the alkali of choice. The degree to which the fiber is rinsed after cooking can also change its quality. A brief rinse leaves behind more of the hemicelluloses and binders that have been worked loose during cooking, and their inclusion in the fiber stock creates a crisper sheet. However, leaving behind too much residual matter can affect the paper’s longevity. A more thorough rinse will tend to leave only the cellulose behind, creating a softer, more flexible sheet.

Before beating, the cooked, rinsed fiber is generally picked over to remove any remaining bits of black bark and other debris, in a process referred to as *chiritori*. One papermaker suggests that although he will pick out any bits he sees during the preparation of the fiber, he essentially skips the *chiritori* process, because he feels the occasional bit of debris or black bark adds a certain “flavor” to the finished paper. His papers are generally used by brush artists who seem to prefer them to “perfectly”

clean papers. Nevertheless, from a conservation standpoint, his practice may be inadvisable.

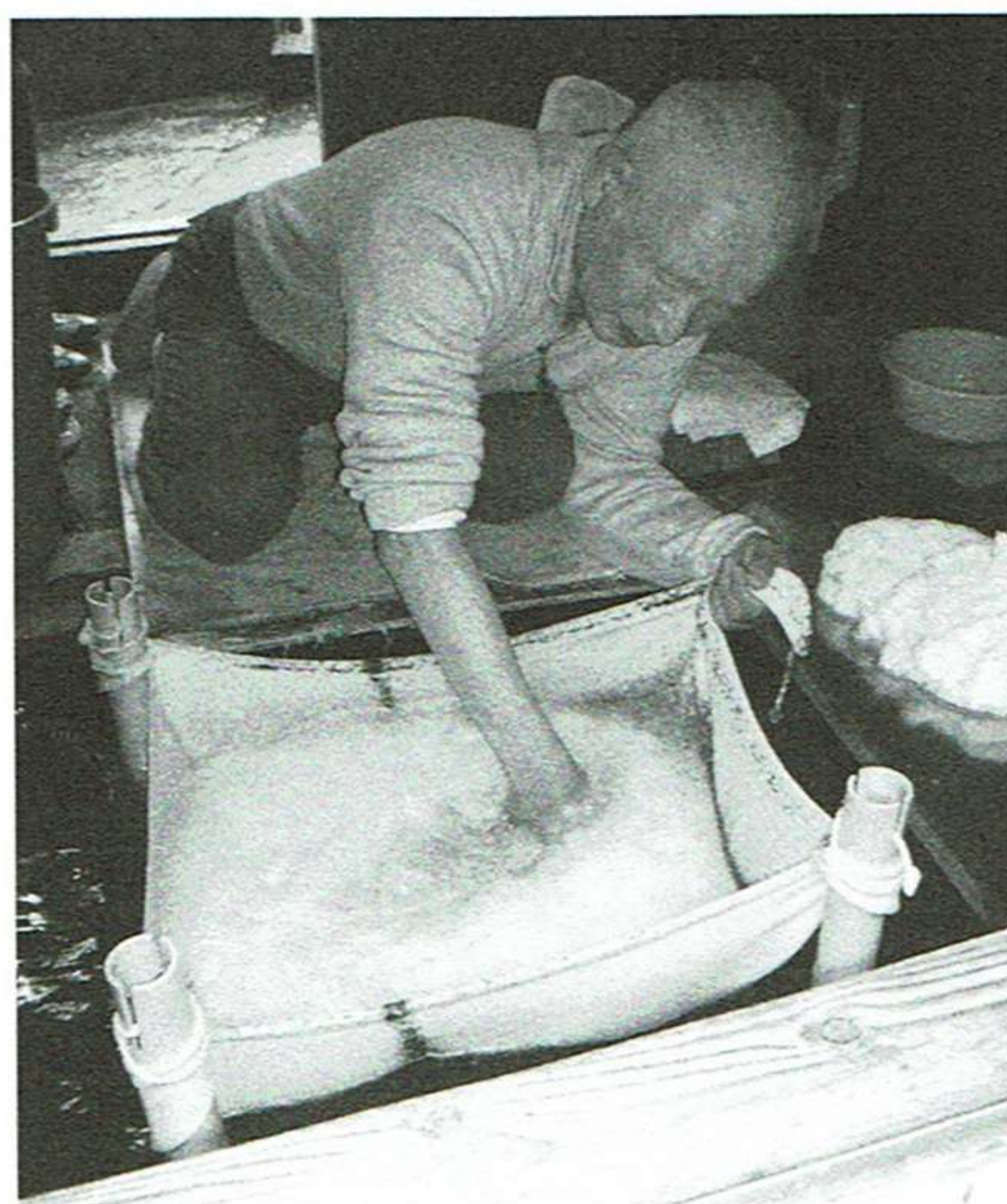
4. Beating

Many papermakers I have talked to receive orders from time to time for paper which is made from fiber beaten entirely by hand, but there are few who normally prepare their fiber this way. Most papermakers today use a *naginata* beater and some also employ a stamper. The *naginata* is convenient and produces a homogeneous fiber stock, but its aggressive action tends to slightly shorten the fiber. If fiber length is critical, then hand beating the fiber is the best choice, as it is the gentlest approach, and tends to leave the fibers intact. It does not involve rinsing, thereby producing a stronger and crisper sheet. However, it takes time and strenuous effort, and it is often difficult to achieve the same kind of homogeneity with hand beating alone. Many papermakers settle in the middle, doing most of the fiber separation by starting with hand or stamper beating, and then finishing the process in the *naginata*, sometimes for as few as 60 seconds or so.

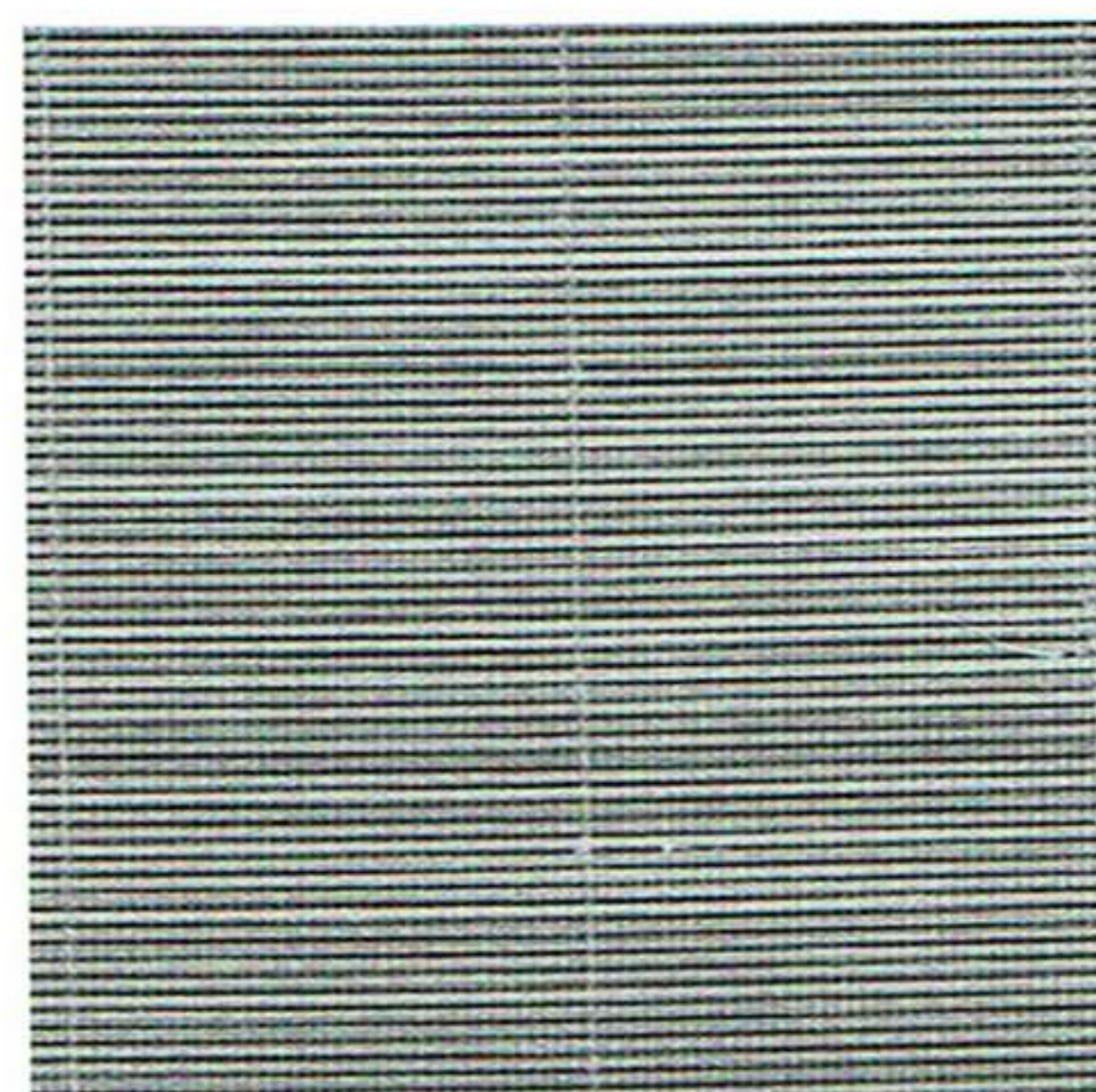
For most papers, the bark strands are carefully rinsed after cooking, but historically, all of the best papers were made from fiber that was also rinsed after beating. Currently, Tengujo and Hosho, among the thinnest and thickest of Japanese papers, respectively, are still produced by rinsing the fiber extensively after beating to remove any remaining impurities and excess hemicelluloses. In the case of Tengujo, this allows for the web-like effect with openings between the fibers; and for Hosho, the rinsing affords the paper its signature softness.

5. Forming

The preparation of the papermaking vat also has a range of possibilities. Some additive may be mixed in, such as clay or shell powder. This helps to even out the surface of the paper by filling in the spaces between the kozo fibers, prevents expansion and contraction of the finished sheets, and also reduces insect



Iwano Ichibei rinsing beaten fiber in a process known in Imadate as kamidashi. 2007.



Details of a su with fine bamboo splints (top), a su with medium bamboo splints covered with a sha (middle), and a su made from kaya (bottom).

damage. Selecting the appropriate formation aid (or *neri*) can help the papermaker achieve the right “shake” for different types of paper. For instance, when making Tengujo, a papermaker will use a very strong formation aid to allow for the rigorous action required to make the thin, tissue-like paper. One papermaker explained that he uses the bark of the *nori utsugi* tree for *neri*, as it gives him the right action at the vat to make his type of paper. The more common and less expensive *tororo aoi* would not allow him to make *his* paper. Especially in warmer months, a small percentage of papermakers use synthetic *neri*, a polyacrylamide whose long-term effects are still unknown.

The papermaking screen (or *su*) in Japan is commonly made from bamboo splints; these splints range in diameter from 0.6 to 1.8 mm. However a *su* may also be made of micanthus reeds (or *kaya*) whose shape is more variegated, and which have a larger diameter (between 2 to 2.5 mm). Papers made on a *kaya su* have a distinct pattern on the surface. A *kaya su* or a *su* with wide bamboo splints may often be covered with a *sha*, a mesh usually woven from silk. Using a *sha* minimizes or eliminates the impression of the *su* in the finished sheets.

Generally, paper is made in Japan using the *nagashizuki* technique in which the papermaker moves the mould vigorously, building up layers of fiber and throwing off the excess pulp back into the vat. Some papers are made using the *tamezuki* method (similar to Western-style papermaking); others require a combination of the two. The style of the shake can make a huge difference in the finished paper. A high-speed, vigorous action, such as that used to make Tengujo, tends to create thin, soft sheets with even formation, while a relaxed, leisurely shake tends to produce thicker, denser sheets with a cloudy formation. Most papermakers shake the mould predominantly back-to-front with some occasional side-to-side motion. Some papers, like *shifugami*, are made with a back-to-front movement only, to align the fibers in just one direction, critical for spinning paper thread.

Water quality is also critical, and lends its own characteristics to the finished paper. There is no set source for water among papermakers. Some use water collected from mountain runoff; some swear by river water; and others use city tap water, filtered or not. One papermaker I spoke to insisted that if the same fiber was processed using water from various regions of Japan, the difference in the finished sheets would immediately be noticeable.

Though it may not fit neatly within the category of “formation,” I should mention the seasons. It is generally believed that the fresher the fiber and *neri* are, the better the finished paper will be. In warmer months, the fiber spoils quickly and the *neri* loses its strength, while in the coldest months, the fiber and *neri* stay fresh longer. Traditionally in Japan, farmers made paper during the winter months when work in the fields was slight. Today, some papermakers produce the same kinds of papers year-round. Others make their “best” or “namesake” papers only in the winter months, and produce lesser quality papers during the summer. A small percentage of papermakers refrain from making paper during Japan’s hottest and muggiest days, instead tending to their kozo field, maintaining and repairing equipment, or cleaning the studio.

6. Pressing

Pressing is the one step in the process where there is little room for variation. The main difference seems to be in the speed with which the post is pressed. While slow pressing aligns with



Paper drying on boards on top of the snow, Oguni Washi Papermaking Studio.

conventional wisdom, I have witnessed a number of papermakers who press the post quite rapidly, much faster than I would ever think advisable. In an interesting variation, one papermaker, who produces thin, short-fibered paper for brush calligraphy, allows the pressed post of paper to dry completely as a block, later rehydrating the post before peeling up the sheets one by one to dry them on a stainless steel dryer. This pressing method lessens the difficulty of parting these delicate sheets. I would hazard a guess that the chemical bonds produced during the initial drying process (through hydrogen bonding and hornification) remain after the post is rehydrated, making the sheets stronger and easier to part.⁸

7. Drying

The character of a paper is affected greatly by the manner in which it is dried. A heated metal plate is a fast, reliable, and convenient drying surface, but harsh on the fibers. Today, stainless steel is used, but in the early part of the twentieth century when metal dryers were first being used, steel sheets were employed which left metal traces in the paper and eventually led to foxing. Even with stainless steel, some suggest that traces of metal are still being transferred to the paper. Drying on wooden boards is a more natural process; the board gets wet when the sheet is applied, and as the sheet dries, the board dries along with it, contracting at about the same rate, thus reducing stress to the fibers. Drying on boards is usually done outside in direct sunlight which has the added effect of whitening the sheets. In winter, the boards can be set out on the snow, and the reflected sunlight can further increase the whitening.

8. Curating

Most papers are inspected and graded before shipping to the distributor or being put on the shelf for sale to customers. The sheets are sorted according to weight. Differences in thickness, or other imperfections that can impact properties such as strength or look through, are generally sorted out at this time. However one must remember that washi is *handmade* paper, and differences in terms of grams, or other subtle imperfections are impossible to avoid entirely. The papermaker may also decide to store the paper for a few months or even years. This aging

process helps to strengthen the bonds between the fibers and “settle” the paper. One papermaker I spoke with refuses to ship any paper that has not been aged at least two years.

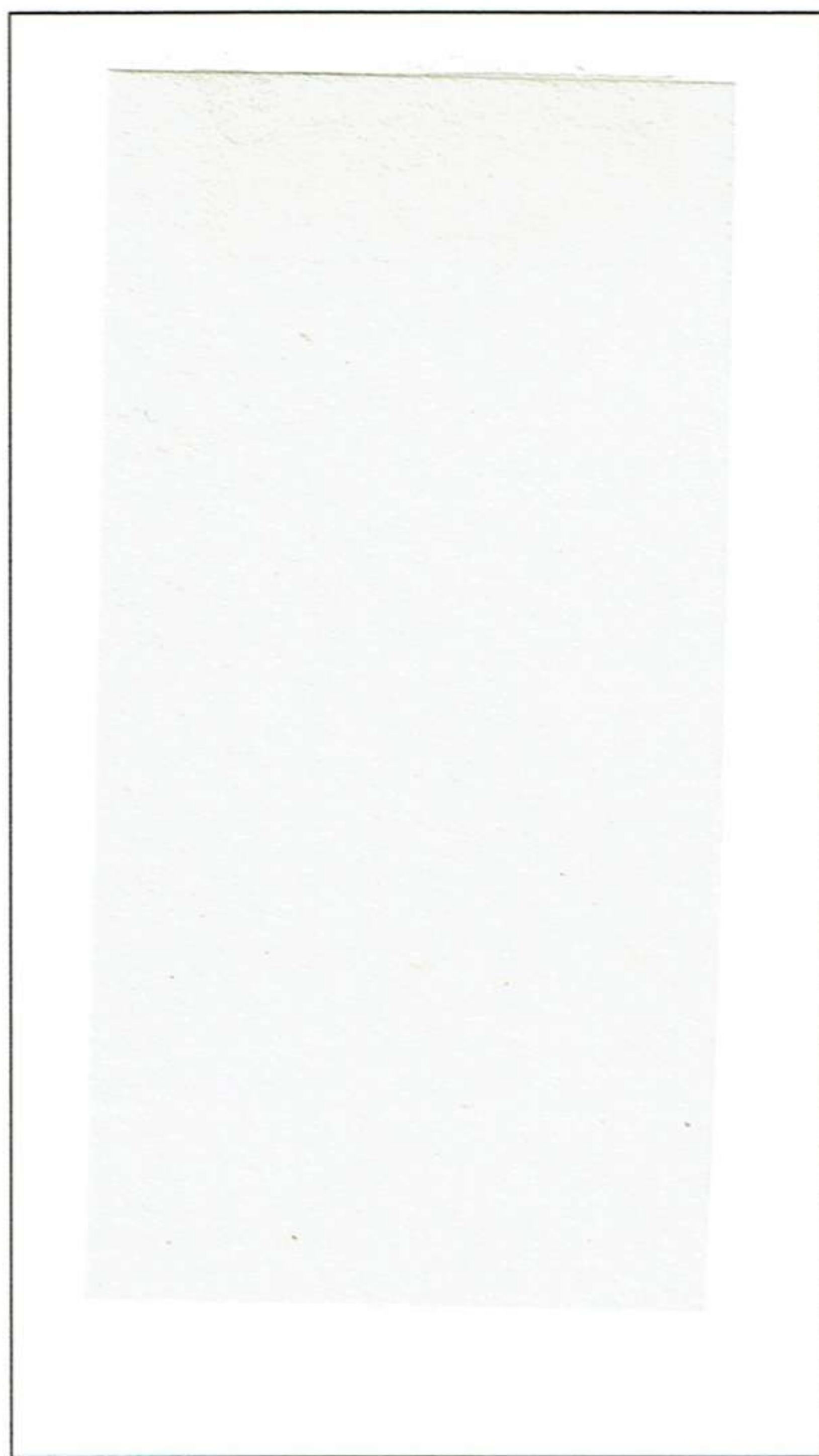
I hope this brief discussion of the varied possibilities in production methods will encourage readers to spend time, ask questions, and carefully consider the options when selecting Japanese papers. As I have focused this article on kozo, please be aware that mitsumata, gampi, and other fibers have their own set of subtleties.

There is no such thing as a “good paper,” only a good paper for a certain purpose. A responsible paper supplier will be able to provide details about a paper’s fiber content and production methods, and advise you as to which papers are appropriate for your project, and why. If your supplier does not have the information you need, ask them to investigate for you.

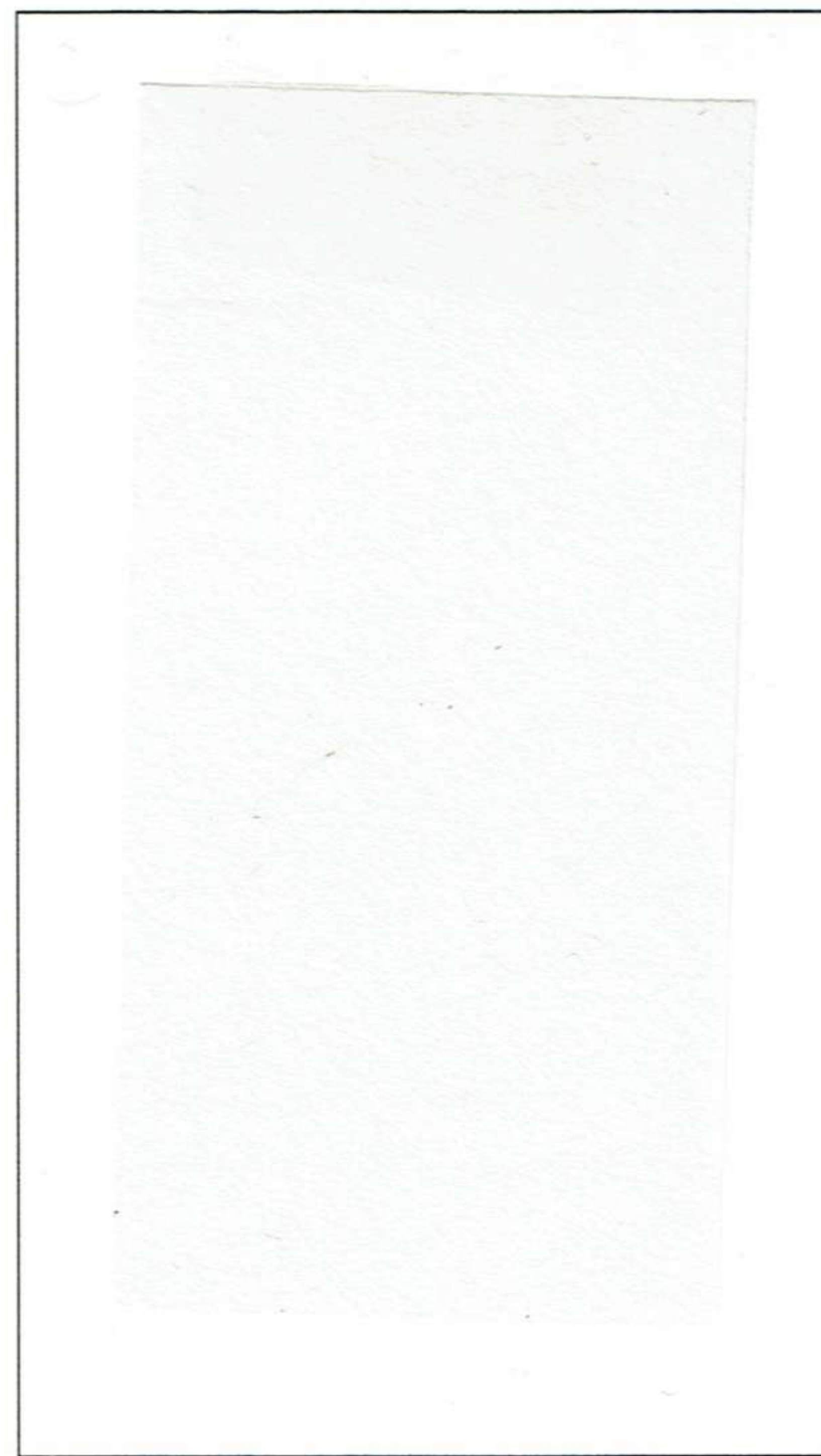
If you are making the paper yourself, remember that there is no “one right way,” only the suitable set of materials, equipment, and techniques to make a paper for a certain application. It may be necessary to experiment with a range of fibers and production methods to arrive at something appropriate for your specific needs. Take careful notes and document the differences between each batch of paper: how the fiber behaves during production, and how the finished sheets look, feel, and work in application. Over time, this documentation can be very useful, allowing you to repeat and to adjust your recipes to achieve the perfect paper for your needs.

NOTES

1. For a discussion of the variety of paper uses rather than production techniques, see Sukey Hughes, *Washi, the World of Japanese Paper* (Tokyo: Kodansha, 1978), especially the chapters entitled “Evolution” and “The Japanese Papers.”
2. This article addresses details of the process, without fully describing the main steps. For a basic introduction to the process of Japanese papermaking, see Donald Farnsworth, *A Guide to Japanese Papermaking* (Oakland, CA: Magnolia Editions, 1989).
3. Papermakers have long distinguished many more varieties of kozo than have botanists. Furthermore, papermakers have worked hard to discover the most suitable applications for each. For example, umbrellas and lanterns are generally made with paper produced from a coarse variety of kozo (taori), while the thinnest sheets, such as Tengujo, are made using a particularly fine variety (akaso) as described by Shishikura Satoshi in *Washi no rekishi: Seihō to genzairyō no hensen* (Tokyo: Insatsu Choyokai Foundation, 2006), 20.
4. Over time, different Torinoko blends have come to be very popular for specific applications. Various naming schemes have been devised to differentiate one Torinoko from another, but the modern reality is confusion.
5. While they are rare, there are papers that are made without cooking the kozo fiber at all. In those cases, the fiber is retted or steamed. I have not had the opportunity to see these papers being made, but I have talked with papermakers of both types.
6. Many of the observations in this section rely on details from Timothy Barrett, *Japanese Papermaking: Traditions, Tools, and Techniques* (New York, Tokyo: Weatherhill, 1992), 37–38, 145–149, 248–250.
7. Kume Yasuo, *Washi bunka jiten* (Tokyo: Wagami-do, 1995), 10.
8. In *Japanese Papermaking: Traditions, Tools, and Techniques*, Barrett defines hydrogen bonding as the bonds that occur when two fibers or fibrils come in close molecular contact during drying. In his January 17, 2007 e-mail message to me, Barrett described “hornification” as a process wherein the soft portions of beaten fiber and fibrils harden or “hornify” during drying.



MIZARASHI (unbleached paper)



YUKIZARASHI (snow-bleached paper)

Oguni Washi Paper Samples: Unbleached and Snow-Bleached Kozo

PAUL DENHOED

The kozo paper samples above were produced in Oguni village in Niigata prefecture. On the left is *mizarashi*, or unbleached paper, and on the right is *yukizarashi* paper which is made in the same way as *mizarashi* with the added step of laying out strips of kozo bark directly on the surface of a snowy field on a cold sunny day.

The fiber is local kozo, grown in a field 20 minutes away from the studio, which is carefully tended by Imai Hiroaki and his staff. As the bark is stripped from the shoots, it is separated into two grades; the superior grade was used for these samples. The top portion of the green layer is scraped away, and any visible imperfections are carefully removed with a knife. At this point of the process, the fiber is snow-bleached for *yukizarashi* paper (see the description on the facing page). The alkali used for cooking is a wood ash lye; the material used to produce the ash is predominantly walnut. Following the cook, Imai rinses the fiber gently but thoroughly and then carefully screens the fiber for debris (*chiritori*). Afterwards Imai beats the cleaned fiber first in a stamper-type beater and then in a *naginata* beater. The sheets are formed using the *nagashizuki* technique on a bamboo *su*, using *tororo aoi* for *neri*. Sheet forming is done exclusively in March and April. After pressing slowly, the sheets are dried on a stainless steel dryer. The finished papers are carefully examined to remove sheets with unwanted imperfections, and separated into 10 weight grades. The papers here are considered midweight at 6 *monme*. The finished sheets are aged in the storeroom for a minimum of one year before being put out for sale.

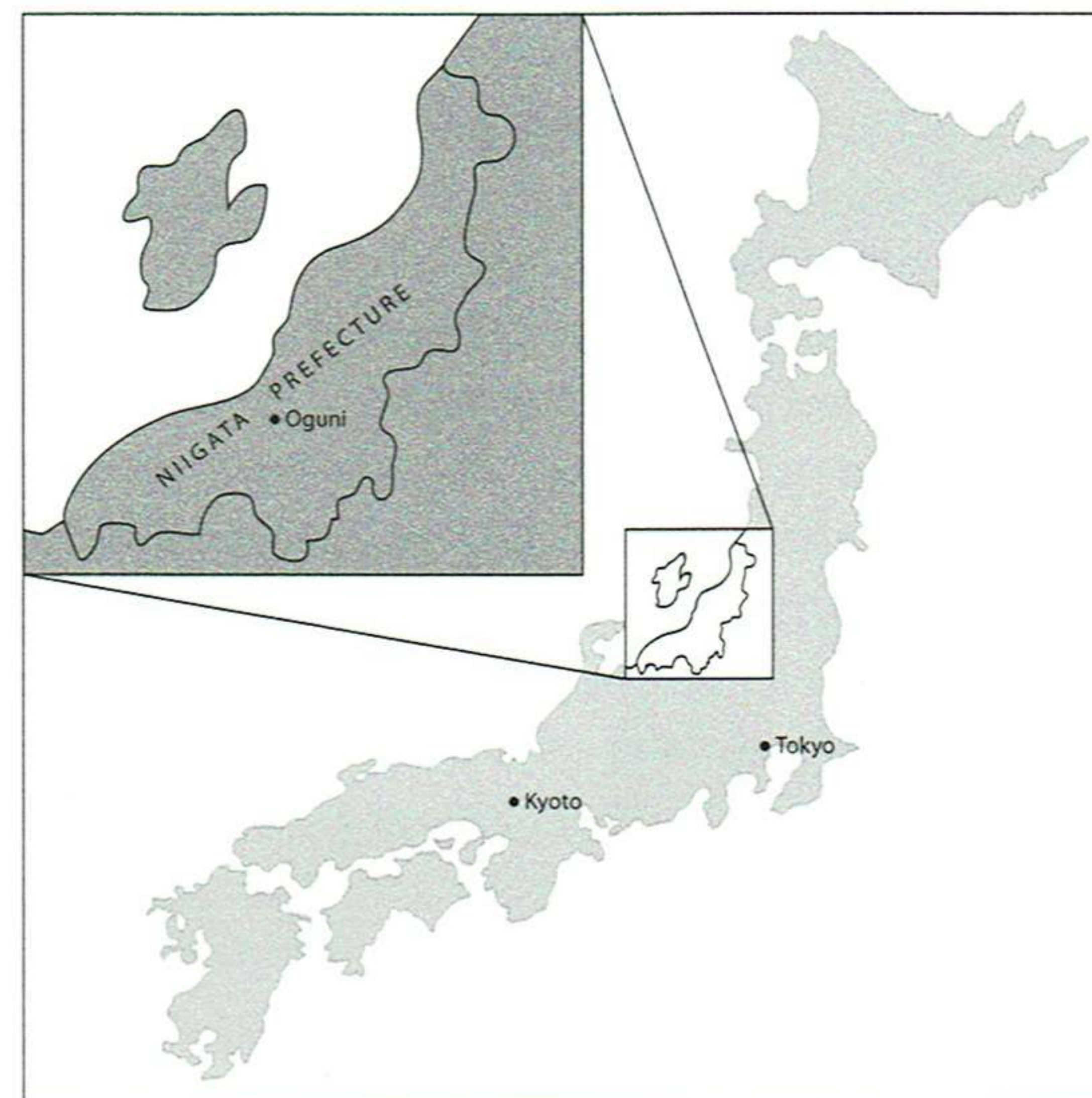


Imai Hiroaki lays strips of kozo bark out on the snow for snow-bleaching, Oguni village. Courtesy of Imai Hiroaki.

Snow Bleaching

To whiten kozo fiber using natural means, the papermaker will expose the scraped bark to the sun, the snow, the cold, or some combination. Generally the process occurs prior to the cook, but in some cases it occurs after cooking. Sometimes the bark is simply hung outside in a location with good sun exposure; or laid out carefully in a shallow part of a river. One further variation I have heard about is to hang wet bark outside overnight, simply exposing it to the wind and cold. Not a lot has been written about these natural bleaching processes, even in Japanese.

With snow bleaching (*yukizarashi*), it seems that the combination of the sun, the snow, and the cold is what produces the dramatic whitening effect. The bark is either laid out directly on the snow's surface, or hung on horizontal poles above the snow. In some places, the process is completed in one day; in other locations it may continue for a week. In some regions, a small amount of snow is sprinkled on top of the kozo bark to expose both surfaces of the kozo to the snow. Beyond the obvious whitening power of the sun's UV rays, it was explained to me that ozone gas and hydrogen peroxide, which both occur naturally as snow melts, also contribute to the whitening process. I hope to have the opportunity to investigate this further and to verify the science, but in the meantime, it is impossible to argue with the results, as seen in the paper samples on the facing page.



Map of Japan showing the location of Niigata prefecture, and Oguni village. Map by Paul Denhoed.