In Search of the Perfect Benchstone

The pros and cons of Arkansas stones, ceramic stones, diamond lapping plates and waterstones

by Brian T. Derber

The author checks a stone for flatness*—To hone an accurate bevel on a cutting tool, such as a plane iron, a benchstone ought to be at least 0.001 in. flat over its surface, measured diagonally.*

When I studied violin making in the early 1980s, the first lesson I learned was how to hone a block-plane iron. Honing my hand tools became a daily practice. I think I spent more time sharpening tools than working with wood that first semester.

Straight-razor hones, what barbers used before the advent of disposable razor blades, were the benchstones of choice at the school. A student could opt for ordinary oilstones, but they were frowned on by our teachers because of the risk of cutting oil contaminating our violins. The razor hones used water as a cutting fluid. Several students had heard about Japanese waterstones, but these were new to the U.S. market. And none of us was willing to spend the money on a set, especially when a couple of dozen razor hones were the same price.

Last fall, I opened my own violin-making school. My first lesson, of course, was showing my students how to sharpen a block-plane iron. I offered them the use of my razor hones until they could buy their own. But when I tried to order additional hones, I discovered they were no longer available. We had to look at other options and decided to sample a variety of benchstones.

We evaluated five types of benchstones

My students and I tried Arkansas stones, Japanese waterstones, Norton waterstones, ceramic stones and diamond plates. We judged the benchstones on flatness (see the photo above), ease of

Photos: Anatole Burkin

use, speed of cut, how sharp they made our tools (see the story on p. 81) and how much maintenance they required.

Many different hand tools are used for violin making. We concentrated on sharpening plane irons, from small finger-plane irons to standard-sized bench-plane irons. These irons are made of high-carbon steel or high-speed steel, which is very hard. The benchstones were used for hundreds of sharpenings apiece over the course of a month. It soon became apparent that there wasn't one clear favorite. There were drawbacks to all the stones, but our favorites were the ceramic stones and the Norton waterstones.

My students and I liked the ceramic stones because they cut as aggressively as waterstones but weren't messy because they are used dry. The ceramics produce a nice polished edge on both high-carbon and high-speed steel tools. But the drawbacks are the stones are only 2 in. wide and aren't as flat as we'd like. Unlike waterstones, they can't be flattened.

We also really liked the Norton waterstones. They're big, about 3 in. wide, have a slightly harder bond than Japanese waterstones and can handle high-carbon and high-speed steels. But owning waterstones requires a disciplined personality, You need to flatten them frequently because they dish out rapidly.

Arkansas benchstones are good for high-carbon steel

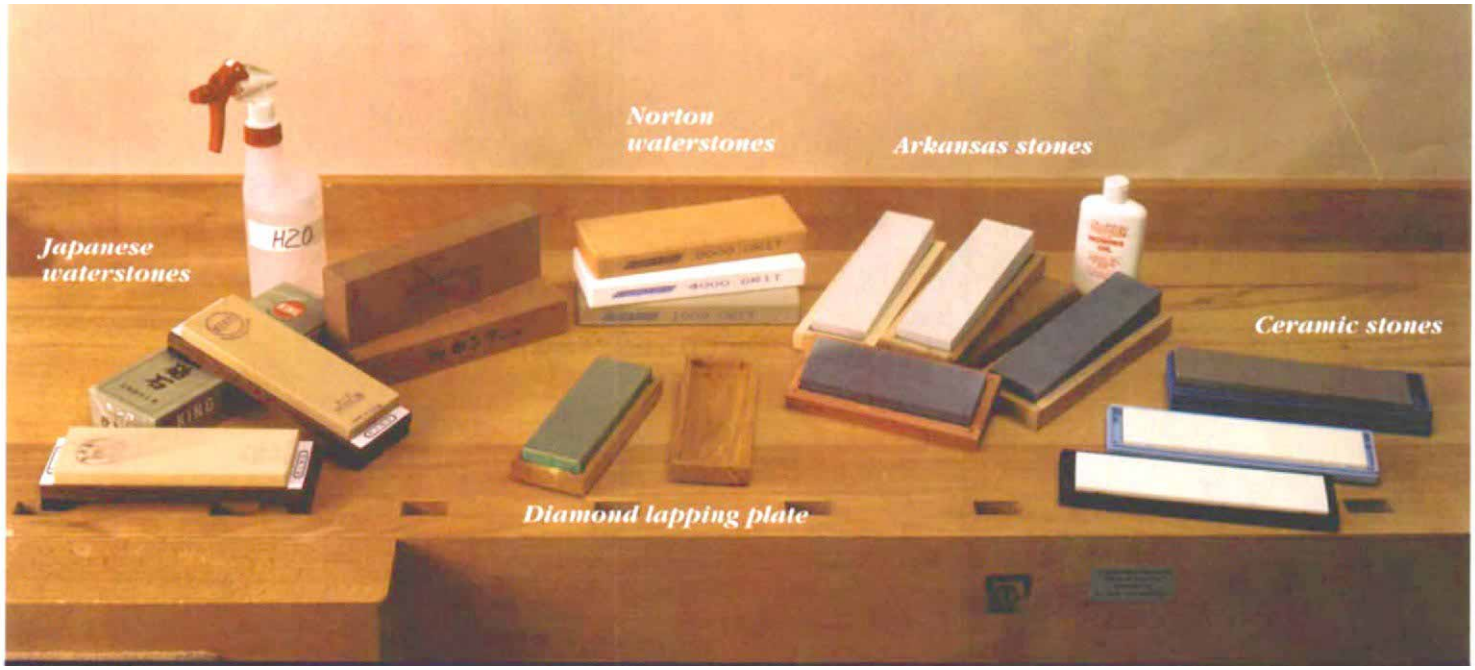
Native Americans used the pure silica rocks from the Ouachita Mountains of Arkansas and Oklahoma for tools and weapons long before they had knives to sharpen. Beginning in the 1800s, large-scale mining began for these rocks of novaculite, which were found to be excellent for sharpening tool steel. They have been the benchstones of choice for generations of American woodworkers (see the photo at right).

Arkansas stones are graded according to grit size and assigned various trade names. Washita is the coarsest, and soft Arkansas is considered a medium grit. There's a difference of opinion about which stones are the finest grit. Some manufacturers rate black Arkansas as the finest grit, but others say that the translucent and true-hard are the finest. In either case, these three stones are not that far apart on the grit scale, ranging from 900- to 1,200-grit, depending on who you talk to.

The abrasive in all Arkansas stones is

Benchstones subjected to hundreds of sharpenings—*Students Korinthia Klein, left, and Leslie Arendt helped the author evaluate four types of benchstones (above).*

Arkansas stones are fine for high-carbon steel *But high-speed steel tools take too long to sharpen on these stones (left).*



Benchstone comparison

Type	Uses	Pros	Cons	Cost
Arkansas stones	High-carbon steel tools	Stones are hard, don't dish out quickly.	Oil-cutting fluid can contaminate wood, won't cut high-speed steel.	$20-$75 each, depending on size and grit
Ceramic stones	High-carbon steel and high-speed steel tools	Stones cut aggressively, can be used dry.	Medium and fine stones are not as flat as other stones, can't be flattened.	$30-$52
Diamond lapping plates	High-carbon steel and high-speed steel tools	Laps have long life span, won't dish out.	Laps are not available in ultrafine grits.	$25-$75 each, depending on size and grit
Japanese waterstones	High-carbon steel and high-speed steel tools	Stones cut aggressively, can be flattened.	Stones must be used with water, frequent flattening required.	$20-$75 each, depending on size and grit
Norton waterstones	High-carbon steel and high-speed steel tools	Hard resin bond gives positive feedback when sharpening by hand, can be flattened.	Stones must be used with water, frequent flattening required.	$20-$70 each, depending on size and grit

primarily quartz. When you buy a specific grade of Arkansas stone, you get a hunk of natural material, and because of that, the grit size can vary slightly within the stone and from stone to stone. We tried Washita, soft Arkansas, black and true-hard.

A light oil is traditionally used as a cutting fluid with Arkansas stones. You can also use kerosene or some mixture of the two. Water can be used too, and some people add a drop or two of liquid soap to the water. Cutting fluid keeps the pores of the stones open and also acts as a lubricant to keep the tool from sticking. The stones we used were nice and flat, within 0.001 in. flat in any direction.

When we used an oil mixture with the fine Arkansas stones, the tool glided easily across the stone; when we used water, the tool didn't rub smoothly across the surface. The drawback with using oil is that it gets on everything, even when we were trying to be neat. If any oil gets in contact with the wood of a project, it may show as a blotch on the final finish. Arkansas stones can produce a good edge on high-carbon steel, but they cut slower than the others we tried. It's pointless to sharpen high-speed steel on these stones because of the slow cutting action.

Maintenance of Arkansas stones is a breeze. They stayed flat after repeated use. Unlike waterstones, they are very hard and don't require constant flattening. They will, however, eventually dish out. To flatten them, it's best to use 34-grit to 96-grit silicon carbide powder on a lapping plate. If cost is a factor and you are only honing high-carbon steel, these stones are fine.

Japanese waterstones can sharpen the hardest steels

In the mid-1970s, Japanese waterstones began to catch on with American woodworkers. You can buy natural waterstones, but they are becoming rare and cost hundreds of dollars apiece. Most Japanese waterstones sold in this country are aluminum-oxide particles bonded with resins. They are priced competitively with other benchstones. The bond in a waterstone is designed to be relatively soft; that allows the abrasive particles to

Japanese waterstones cut aggressively *and are good for sharpening all bench tools. Water is used as a cutting fluid and the stones quickly break down, creating a messy slurry.*

spall off the surface easily, constantly exposing a fresh, sharp surface. Aluminum oxide is just hard enough to handle high-speed steel and some carbides.

We tried the King brand waterstones in four grits: 800,1,200, 6,000 and 8,000. A coarser, 220-grit is available too, and the abrasive is silicon carbide rather than aluminum oxide. This is the stone to use if you need to remove nicks in a tool's edge.

Out of the box, the waterstones were about 0.003 in. to 0.004 in. out of flat. We flattened them to about 0.001 in. tolerance using 220-grit silicon carbide wet-or-dry paper on a piece of flat marble (see the photo at right). A piece of plate glass will work just as well. We found that it was best to keep up the maintenance of these stones, flattening them with a few swipes across the wet-or-dry paper after every sharpening or two. Ownership requires a disciplined personality. They also require a lot of water and can create quite a mess.

The 800-grit and 1,200-grit stones need to be soaked for about five minutes before use. These two stones also felt a bit soft. It is fairly easy to round the bevel of a small tool when using them because it takes a while to get the feel for keeping the tool's bevel perfectly flat while sliding it back and forth across the stone. With larger plane irons, it's easier to sense whether the bevel is positioned flat on the stone. It's also easy to gouge the surface of these stones when sharpening small tools because their edges can catch. But the stones cut very quickly. Japanese stones cut better if you maintain a muddy slurry on their surface. Moving up to the higher

All waterstones require frequent flattening. *That's done with a sheet of 220-grit sandpaper placed on a flat surface, such as a slab of marble.*

Norton waterstones are slightly harder than Japanese stones. *When sharpening by hand, a hard stone makes it easier to sense whether you're keeping the bevel flat.*

Ceramic stones glaze over quickly. *But the residue can easily be scrubbed off with a dish pad and water.*

grits will produce a razor-sharp edge and mirror finish on metal. The 6,000-grit and the 8,000-grit stones don't have to be soaked, just wetted down. We couldn't see a quality difference in edges sharpened on the 6,000-grit stone and the 8,000-grit stone.

Norton waterstones are an improvement

The American-made Norton stones are the counterpart to the standard Japanese waterstones (see the bottom photo on p. 79). They are also comprised of bonded aluminum oxide particles. The bonding agent, however, is slightly harder than what's used in the King stones.

We tried three different grits: 1,000, 4,000 and 8,000. (A 220-grit coarse stone is also available.) The stones came out of the box 0.001 in. flat across their surfaces.

The 1,000-grit and 4,000-grit stones need to be soaked in water before use, just like the Japanese waterstones. The Norton stones are slightly harder than the Japanese stones, so they provide greater feedback and, therefore, better control when sharpening. But the speed and quality of the cut are indistinguishable from the Japanese waterstones.

Even though the Norton stones are an improvement over the Japanese stones, they seem to dish out almost as rapidly and can be nicked just as easily, especially by small tools. Like Japanese stones, they are messy and require periodic flattening.

We did have a problem with the 1,000-grit stone. After it had been flattened, the stone didn't cut as aggressively as it had initially. The company assured us it was part of a batch of stones manufactured with an overly hard bond, and we could send it back for a replacement.

Ceramic stones are narrow but cut well

Ceramic stones are made of aluminum oxide particles mixed with a ceramic bonding agent, compressed at high pressure then fired in a kiln. This process makes them extremely hard. We tested three stones from Spyderco: medium, fine and ultrafine (see the photos at left).

The medium and fine stones were within the company's specification of 0.010-in. deviation from flat across any direction. For my needs, that's not flat enough. The ultrafine stone is manufactured to higher standards, and it was within 0.001 in. of flat, what I consider acceptable.

We all liked the fact that these stones are used dry. They did not dish out and seemed to be impervious to surface nicks. They excel at honing the smallest of cutting blades. The ultrafine stone clogs up quickly with metal particles and tends to glaze over. But it, as well as the others, can be scrubbed clean with an abrasive dish pad and water.

Ceramic stones cut fast, much like waterstones. The ultrafine stone will produce a highly polished and extremely sharp edge, as good as the 4,000-grit or 6,000-grit waterstones. Because these stones are so hard, they cannot be flattened. We tried flattening the medium stone anyway, and sure enough, it no longer cut aggressively.

Diamond lapping plates are best for initial honing

Diamonds are the hardest natural material and will cut any type of metal. We tried two different kinds of laps, both graded at 1,200-grit (U.S.). One is manufactured by Diamond Machining Technology (DMT); the other is by Eze-Lap (see the photo at right). The DMT lap uses monocrystalline particles, and the Eze-Lap uses polycrystalline. Some experts say the monocrystalline diamonds will last longer, but in our short evaluation, we couldn't detect any difference in wear.

Both laps are available in various sizes and grits ranging from 220-grit to 1,200-grit. The Eze-Lap plate is just that, a plate of steel with diamonds bonded to one face. The DMT stone, however, is perforated steel and nickel plate glued onto a plastic base. The plastic is nearly flush with the perforations, which the manufacturer says act as reservoirs to hold metal shavings. DMT recommends water as a cutting fluid; the Eze-Lap plate can be used dry or with water.

The Eze-Lap we used was very flat, but the DMT had a minor twist in it. Although the 1,200-grit stones are described as extra-fine, for our purposes, we consider them medium stones, good for initial honing. Sharpening with only a 1,200-grit diamond plate leaves fine serrations on a plane iron's edge, which then get telegraphed to the wood being planed.

Gliding a tool across the Eze-Lap feels similar to using a ceramic stone. When honing very small tools over the DMT stone, however, the edges of the tools sometimes catch on the perforations.

For ease of use, maintenance and portability, the diamond laps are superior. They will cut any steel put to them, cut dry or with a bit of water and will never dish out. Both stones cut quickly. □

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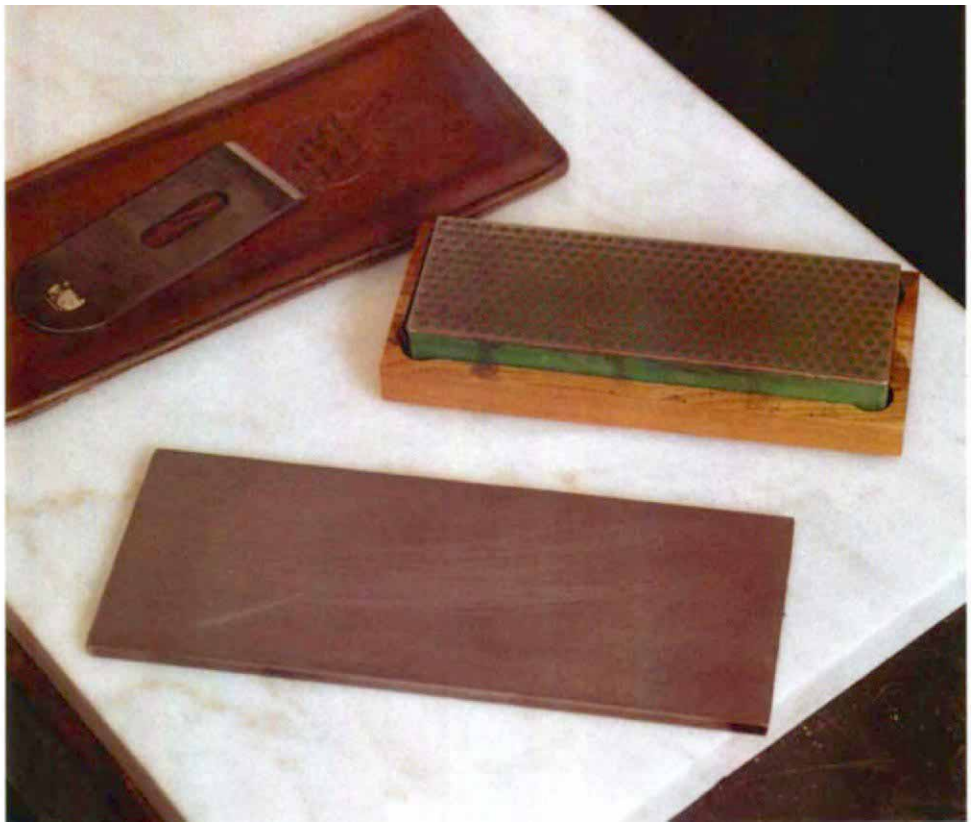

***Two types of diamond plates**—The DMT plate, top, has a perforated surface. The surface of the Eze-Lap is solid. Both can handle high-carbon and high-speed steel tools.*

How sharp is sharp enough?

To get a tool razor sharp, you have to hone and polish the cutting edge to a mirror finish. The quickest and most accurate way for me to check sharpness is to slide my finger gently across a tool's cutting edge (see the photo at right). When I feel a smooth drag, that tells me that the edge is free of nicks and sharp enough to effortlessly slice a very thin layer of skin. If the edge is dull, my finger will glide right across the edge. A semisharp blade will drag and skip across the skin, which means it still has some rough spots.

If you don't wish to risk cutting yourself, you can substitute your fingernail and look for the same qualities. There's also the time-honored method of shaving hair off your arm, although I don't think it's as accurate as using a fingertip. A very sharp blade will cleanly shear hair off. A semisharp blade will burn as it cuts, like a dull razor. *—B.T.D*

***The author uses a fingertip to judge blade sharpness.** A finger passed lightly over a razor-sharp tool will drag smoothly. Catches indicate rough spots.*