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ficer, or member of an organized rescue or fire fighting force in the performance of an official duty; and

(5) Persons engaged in a business, trade, or occupation in the area.

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We wanted to take this opportunity to point out that claimholders are considered private property landowners under the law.

PLP northern director Clark Pearson stated, "Thanks to the *U.S. v. Hicks* case, the courts have acknowledged that claimholders are owners of land within the National Forest who are exempt."

In this court case from 2002, Hicks was convicted in the US District Court for the District of Montana for operating a vehicle (motorcycle) in an area of the National Forest closed to motor vehicles by a Forest Service closure order. Hicks appealed, and the 9th Circuit Court of Appeals found that Hicks was acting as an agent or employee of a corporation that owned subsurface mineral rights in the National Forest and was not subject to a Forest Service closure order that exempted landowners. (The case is available online at www.publiclandsforthepeople.com or you can find it by searching for "US v. Hicks No. 01-30146.")

But let's be clear: At no time will we advocate heading into any area that could put you in danger or endanger those who might have to come to your rescue. Common sense must prevail.



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See this month's story on page 43.

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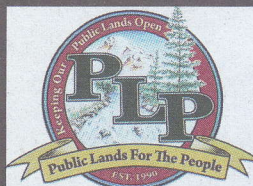
HARD ROCK 101: ADVANCED MICRO BLASTING

by John Norman

Since the article on micro blasting was published (June 2020 *ICMJ*) I have received several requests for more details on this subject. Today's article will cover some more advanced ways to use this technique to break rocks.

Micro Blasting Recap

If you have been following the "Hardrock 101" series of articles, you know that rock is very strong in compression and much weaker under tension. And that a force acting from behind or inside the rock can pull it



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apart much more readily than tons of force applied from the outside.

Micro blasting is a way of getting small charges of smokeless propellant into the center of the rock mass, igniting them, and letting a violent reaction, facilitated by confinement, crack the rock. The systems use a combination of pre-made cartridges with an electric or non-electric igni-

tion system and a tool that fills or "stems" the hole as well as providing a means to set off the blast.

Two main products are available for this—Ezebreak, and SierraBlaster. Both are furnished as kits with all necessary tools and supplies and they use similar amounts of powder (around 1 gram per cartridge). The main difference between them is that

the SierraBlaster uses electrically-primed cartridges that are water-resistant and the Ezebreak uses non-electric cartridges containing a shotgun primer. Ezebreak cartridges are not waterproof.

When used as directed, these systems will break rocks that would be very difficult to handle by other means. Unlike explosives, they aren't specifically regulated in most jurisdictions and the cartridges can be shipped by UPS or FedEx. They also create negligible fumes and much less fly rock than blasting. Below are some tips on maximizing your effectiveness with these tools.

Tip #1: Read the Instructions

Both the SierraBlaster and Ezebreak require completion of an online training course in order to buy cartridges. The training covers safety, legal and basic operating procedures for each product. Pay attention to the training and the printed instruction sheet supplied.

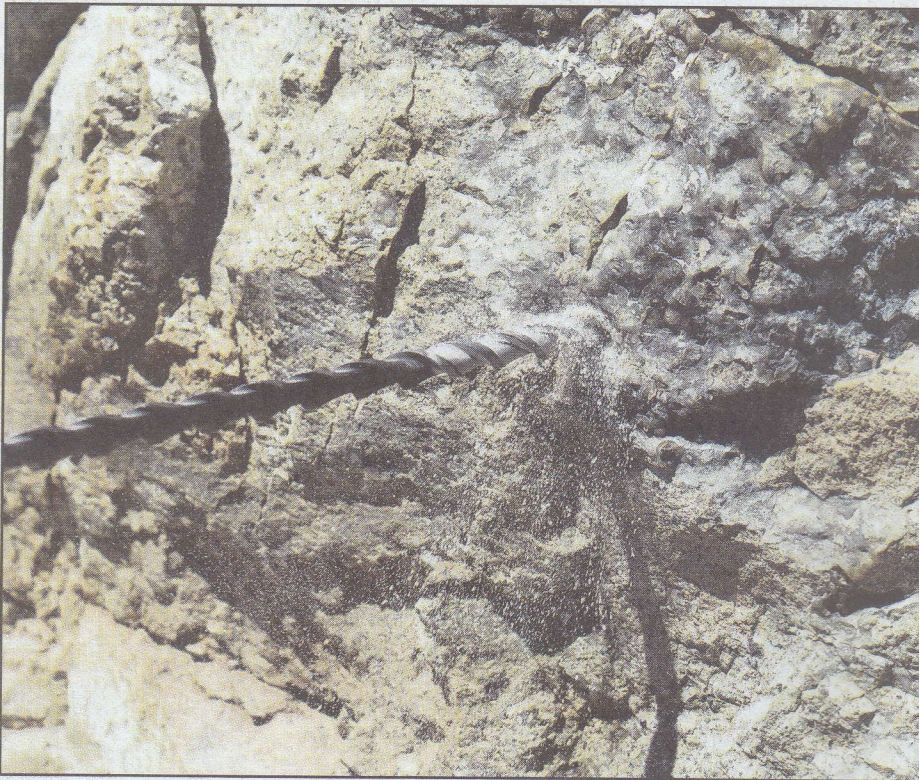
The SierraBlaster comes with a "leash" system that should be deployed to keep the heads from flying out and becoming a hazard or getting damaged. The Ezebreak requires a compressed air source to initiate, and there are specific recommendations for hooking up multiple heads that must be followed to assure reliable operation. These and other less obvious tips are covered in the manufacturer's material and its worth taking the time to study it.

Tip #2: Choose the Right Drill

After extensive testing, I can report that both systems work fine with either a cordless or 110V hammer drill. I recommend only using the smaller "SDS+" style tools for drilling your blast holes. The hole sizes are 10mm or less, and the larger "SDS MAX" drills hit much harder than necessary for such work. They also deliver fewer percussive blows per minute. The net result is that big hammer drills damage small bits easily and actually take longer to make a hole. Use the large SDS MAX tools for chiseling out cracked rock or drilling relief holes, not small-diameter blast holes.

Tip #3: Buy the Right Bits for the Job

Small-diameter rock bits get hot very quickly, especially the 5/16" size



Drill ripping through quartz rock.

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used with the Ezebreak. It is absolutely critical that you purchase drill bits in several different lengths to maximize performance and life. Start with a 4-6" long drill and then move up in size. You should swap drill bits at least three times to make an 18" deep hole. Doing this allows the drills time to cool and produces straighter holes.

The long 18" and 24" drill bits are easier to damage than the shorter bits. Always carry spares of the longer drill bits, as they probably won't be available in a small-town hardware store.

On the subject of drill bits: Only purchase high-quality, carbide-tipped drills from a reputable maker such as Bosch or Hilti. Premium drill bits in small sizes are not expensive.

Drill bits should be checked frequently for chipped or dull cutting edges and discarded if necessary. Carbide drills can be sometimes be sharpened once or twice on a silicon carbide "green wheel" or with a diamond file.

Note that all drill bits slowly get smaller as they wear out. If you find that you are having a hard time getting your cartridges or blast heads inserted in a clean hole, it might be time to retire that bit.



Setting up a "burn cut" for extracting in-place rock. The large hole in the middle (the burn cut) is not filled with any explosive and the rock breaks to that open space.

Tip #4: Boulders Break Easily; Rock Faces Do Not

With a micro blaster, rocks up to about 2 feet in diameter can be easily broken with one shot. Rocks up to the size of a car can be broken up and removed with a few hours of work. What isn't easy is mining away at a clean, unbroken face. There are a few ways to get around this problem:

1. Try to open up a pocket in the rock by placing the heads at an angle pointing inward, such that a wedge or cone of rock is broken. In a clean rock face, you may not get any rock to eject, but you will at least create cracks that will allow you to open up a pocket with a jackhammer or chisel.

2. If you have the means to drill a 1" or larger hole, try a "burn cut." This is a drill pattern often used in underground mining. The idea is to first drill either one large hole or a "clover leaf" arrangement of smaller holes. Once that is in done, drill blast holes 2" to 6" away from the big holes and shoot them as usual. The large relief hole(s) provide a space for the rock to expand and break into. Breaking will get much easier once you have

cavity started.

3. If there is a layer of weak material in the rock face, try to remove it by power or hand chiseling, then blast towards it. Any relief is better than no relief when you are trying to break into a face.

Tip #5: More Confinement Is Better

When you set the blast heads into the holes, you are closing up or stemming the hole in order to keep the hot, expanding gas inside as long as possible. SierraBlaster recommends placing rocks on top of the heads, and specifies that the lightweight aluminum heads *must* be weighted down. Instead of rocks, try some "theatrical sandbags." These heavy-duty sandbags are used for holding down equipment such as tripods and stage rigging and they come with pre-sewn attachment points. Amazon and other sources sell these unfilled. They are inexpensive and very easy to pack in and fill on-site.

If you are shooting a vertical face, try using a carabiner to clip a sandbag onto each head or pair of heads. This



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reduces the potential for the head to become a flying missile and also improves performance. Some rough-cut lumber can also be used to hold the blast heads in place.

Tip #6: Cleanliness Is Next to Godliness

The diameter of the blast tool is



Demonstrating the use of a theatrical sandbag to give blast head weight and hold it down. The sandbag is attached to the blasting head with a climbing carabiner.

more or less exactly the diameter of the drill bit. The reason the tool can be inserted at all is that percussion drilling produces holes that are slightly oversized. Because the fit is so tight, it is imperative that you thoroughly blow the dust out of your holes with a hand pump or compressed air prior to loading. A small, cordless leaf blower is a great tool for cleaning the holes, and the rock face of dirt and gravel prior to drilling.

Tip #7: Avoid Misfires

Each manufacturer has detailed guidelines for avoiding and handling misfires that should be followed. Some additional advice is also warranted:

1. For the SierraBlaster, make sure that the wire from the cartridge is pulled out straight and any twists are worked out prior to fitting it into the groove. Do not twist the head as you place it or the insulation will become damaged.

2. The Ezebreak requires three things for a successful shot: A dry hole, a firing pin that has been reset with the supplied tool, and a cartridge that is directly in contact with the end of the firing device. Unlike the SierraBlaster, it is actually helpful to twist the head back and forth to ensure it is inserted completely. If you're having trouble getting it in, it's usually because there is still dust in

the hole. A tiny bit of graphite or other dry lubricant can help with insertion. It also pays to use some dry lubricant on the firing pin, as it will not attract dust like oil does. Also take care to not let any rock dust that could block the firing pin fall into the hole after loading.

Ezebreak cartridges that fail to fire can often be fished out using a telescoping magnetic parts retriever from the auto parts store, as there is a tiny bit of steel in the primer assembly.

If a SierraBlaster cartridge fails to fire, it's typically because of damaged wiring. If you clip the wires off, they can be disposed of down a hole as a booster cartridge.

In any case, *always* keep the tool pointed away from yourself while loading or unloading a hole. Treat a loaded hole as you would a loaded gun. Always wait the prescribed amount of time or no less than one minute before examining a failed hole in case a "hangfire" or delayed initiation happens.

Tip #8: Use Water to Increase the SierraBlaster's Effectiveness

Although they aren't certified to be waterproof, SierraBlaster cartridges are quite water-resistant. If you are shooting a vertical hole, pour some water in first to improve the seal and increase the energy cou-



Betty places the blaster head in the hole. It should slide into place without twisting to avoid damaging the electric wires that set off the blast. (Right) cartridge failed to fire. This closeup shows how the wires were damaged due to twisting the head during insertion.



pling. As a bonus, you can also drill a deeper hole than usual and fill it with water to achieve a larger plane of breakage. Underwater rocks can be shot in-place, as long as you can drill them from the surface with a long drill bit.

It is also possible to wet horizontal holes using a reusable caulking tube and gelatin or cable-pulling lubricant.

Tip #9: The Stronger the Rock, the Better it Breaks

Boulders are the easiest rock to break because they have a lot of relief around them. It's also important to consider that they became boulders in the first place because they were stronger than the rock they came out of and relatively free of defects. If you have a choice, drill and shoot into the hardest, least cracked area of the rock that you can.

Four fully-loaded holes in weak volcanic tuff may just result in some cracks, while the same pattern in Sierra granite will violently shatter the material. Very weak rock is a better candidate for removal by mechanical means such as a demolition hammer or chisel.

Tip #10: Consider Alternative Power Sources

The SierraBlaster is initiated with electrical energy. The maker recommends at least 200W per blast head if firing from a generator. We found that a variety of other energy sources work, especially if you are

only shooting 1-2 heads. A portable DC-to-AC inverter hooked up to your truck battery is one option, as is an 18V or larger lithium drill battery. A portable blast box is perhaps the best option, although more expensive. If you do purchase one, try to get one of the higher output models. Why?—you'll want this later anyway if you decide to pursue a blaster's license.

The Ezebreak requires a com-

pressed air source, such as a CO₂ cartridge (good for only one head and 2-3 shots) or an air compressor. I found that a good alternative is a 20-ounce CO₂ cylinder used for paintball guns. At least one company makes an adapter to fit these to a standard high-flow CO₂ tank regulator, as used for filling vehicle tires. The rest of the plumbing is just simple compressed air fittings available from Ezebreak or a hardware store. A fully-charged



A four-blasting head wedge pattern waiting to be anchored in and fired. The holes are angled in like a wedge to give the force of the blast space to break to.

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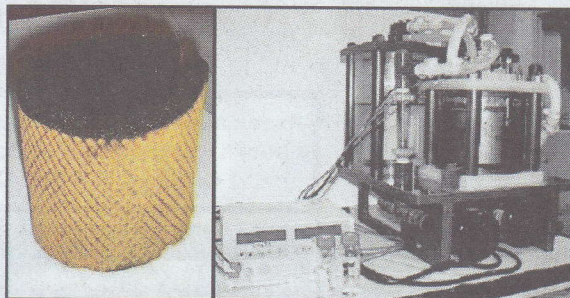
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Tip #11: Maintain Your Tools

Micro blasters are simple devices, but they are used in a very hostile environment. At the end of every day, it's a good idea to wipe down the blast tool with a clean rag. The grooves in the SierraBlaster's blast head can be cleaned with a toothbrush. It is made of stainless steel and has no moving parts, so not a lot of other care is needed.

The Ezebreak does have moving parts, and it should be lightly oiled and periodically disassembled and cleaned as you would a pistol. Either device may acquire burrs and gouges from flying rock. You may need to lightly file down any serious gouges if they interfere with inserting the tool.

Tip #12: Choose the Right Blast Pattern

Just like conventional blasting, the rock will respond better to the right pattern. Some common patterns are:

1. One head set into the boulder's center of mass. If the rock is oblong

or "potato"-shaped, consider where you would like the rock to break and whether there is enough material to drill the required hole in that direction. Holes should be drilled to just past the center of the boulder.

2. A straight line of holes, with multiple blast heads. This is a common pattern for breaking up a large slab. Drilling extra holes between the blast heads will help ensure the rock breaks in the direction you desire.

3. A square or "dice" pattern with 4 blast heads. A pattern of 4 heads arranged in a loose square is a fast way to break up a square or round boulder of considerable size.

4. Horizontal placement along the bedding plane. If you're trying to break sedimentary rock such as limestone, try drilling parallel with the layers of the rock. You can often make a piece just peel off without even leaving a drill scar.

Tip #13: Get Better PPE

Drilling in rock generates dust, and we know that dust is hazardous to our health. An N95 mask is rec-

ommended as the minimum level of respiratory protection against rock dust. With the current COVID-19 situation, real N95 masks are hard to get. Paper masks also don't seal that well and tend to fog up safety glasses.

My advice: Skip the N95 and get a half-face P100 respirator. These are often easier to find and the filters will last a long time—they basically don't need to be replaced until they become difficult to breathe through. As a bonus, your exhaled air is directed away from your eyes and you will not fog up your glasses. And the protection level is higher.

Conclusion

Micro blasting is a cost-effective way for the small operator to break up boulders and extract ore. When used in conjunction with prying and/or power chisel tools, a one- or two-man team can effectively work a mine that could not otherwise be worked without major expense. If you decide to get into micro blasting, consider carrying a small log book with you and documenting each blast day, including number of cartridges used and simple illustrations of patterns and the results you got. This will help you improve your technique and document experience that will be necessary to obtain a blaster's license should you decide to at a later date.

John been involved in prospecting, rock hounding and amateur mining for 20+ years and is a licensed blaster. He currently serves on a Search & Rescue team that covers abandoned mines and other underground rescue in San Bernardino County, CA. He welcomes questions via email: jnorman@accxproducts.com

References

"Hardrock 101: Micro Blasting," June 2020 *ICMJ*

Aaron Klemenok, President, SierraBlaster, LLC.

Charles Harrod, Blasters Tool & Supply Co., Inc.

Keith Bowen, *ICMJ* Author
"Hard Rock University," YouTube channel

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