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**RESURRECTING AN OLD
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SETTING UP THE MILLSITE**

**CLEARING THE
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WITH A DETECTOR**

**SMART PROSPECTING
YIELDS MORE THAN
HOT GOLD**

**HARD ROCK 101:
MECHANICAL TECHNIQUES**



**PLUS:
Melman on Gold & Silver
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PLUS: Melman on Gold & Silver and The BEST Classified Ads!

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freezer overnight. When I asked him about the logic of freezing the steel sleeve(s), he explained that the severe cold shrinks the sleeve(s), making the installation much less problematic. And it did!

That morning I put the compressor in my freezer and left it overnight. The next morning, I retrieved the compressor and again attacked the sticky head bolt. As if by magic (and some applied physics) the head bolt sighed and finally broke loose.

I left the compressor in my shop for several hours prior to continuing with my work in order to allow the compressor to completely thaw. (If you decide to do this, do NOT spin the compressor crankshaft while the compressor is frozen and the bearings and the diaphragm are frozen. Spinning the crankshaft at this time will likely damage or destroy the compressor's internal components.)

So, as the guy on the radio used to say, "Now you know the rest of the story." A little trick I learned from my dad decades ago still works, and I was able to clear dead dirt dauber debris from my comatose compressor. That compressor is still in use as you read this.

Wishing a safe and prosperous dredging season for all!

PS: The original single-slotted screw heads were so badly damaged during this process that I replaced them with Phillips-head style screws.

The author is a retired academic and military guy, and an avid dredger and outdoorsman. He can be reached via email at harry.f.griffin@gmail.com

NOTE: If you have something for our "Tips and Tricks" section, please give us a call or send us an email!



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HARD ROCK 101: MECHANICAL TECHNIQUES

by John Norman

In the previous issue, we covered the basics of rock drilling and mentioned a few ways we can break some rock. In part two, we will be going in-depth on one method: Mechanical Advantage. Since we know that the secret to breaking rock is applying force from the inside out (putting tension on the rock), we will be looking at ways we can generate force using human and machine power.

When Are Mechanical Techniques A Good Fit?

In general, breaking and moving rock without the use of explosives is slow and labor-intensive. It makes sense when you only want to move a small amount of material (sampling or specimen collecting), need to be very lightweight and self-contained (prospecting), or when time and labor are less of a consideration than cost. It is still done every day in developing countries. It's also a viable way to collect extremely delicate gemstones or specimen gold, or when there must be no collateral damage from the work.

Safety

While these techniques generate less dust than drilling operations, it is still present, and you don't want to get that dust in your lungs. All of these methods can create flying rock and steel chips. And remember that a cubic yard of rock can weigh 2,000 to 5,000 lbs. If it should shift, it will easily crush you. Keep your body parts away from any possible fall or roll path for the rock, wear steel-toed boots, take appropriate safety precautions and never work alone.

Techniques

Below are the most common ways to move and break rock mechanically.

Hammer and chisel. Useful for obtaining chip samples, breaking up weak rock or enlarging existing cracks in the material.

Pry bars. Available in many sizes, good for pulling apart rock that is already cracked. You can also move very heavy chunks using the principle of leverage.

Feathers and wedges and bull



Close-up of the tools required for hand-drilling holes the way the old miners used to do it. The bit is rotated after each blow by the hammer.

pins. As we covered last month, these steel wedges multiply and deliver tons of force to a line of drill holes to crack stone. Can be driven with sledgehammers or power tools.

Jackhammers. Can pulverize rock, wedge it apart and lever it out of place. Available in a range of sizes, from SDS+ "chisel bits" for cordless drills to 90 lb+ pneumatic breakers.

Hydraulic Splitters and Saws. Specialty tools used in concrete demolition. Also sometimes used in work such as high-value stone quarrying and mining specimens. Splitters require a large, deep hole, but can deliver hundreds of tons of hydraulic force to the rock through a special expansion head.

Hammering, Chiseling and Prying

This is a commonly-used technique for collecting samples. Its main advantage is minimal investment and little equipment to haul. This works best in soft or fragmented material such as shale, mudstone or conglomerate rock. It can also be a good way to separate hard material such as gold-bearing quartz from a weaker substrate, or to carefully remove fossils from bedrock.

The basic idea here is to find a weak spot in the rock and use a hammer and chisel to create and enlarge a crack or pocket. Once cracks are established, a prybar can be driven into this space and used to lever rock

chunks out of place. The key to levering rock out is to start on the edges and remove smaller pieces holding it in place.

Once your ore has been separated from the host rock, it can be broken into easier-to-handle pieces with a sledgehammer.

About Chisels

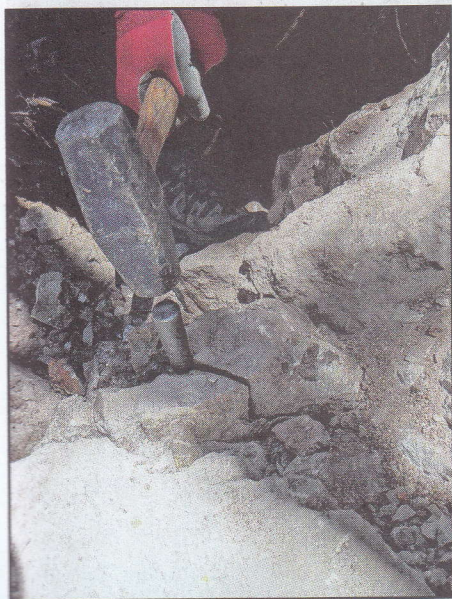
Note that there are different types of chisels. A "cold chisel" is the most common general-purpose type. Its

original purpose was the cutting of "cold" pieces of steel by blacksmiths. A "hot chisel" is much thinner and less suited to rock work. Wider "mason's chisels" are good for cutting softer rock. Some come with a molded rubber handle/guard. These are safer and easier to use.


Very soft material such as bentonite, talc, surface coal or even highly-weathered rock can often be removed as-is with a simple miner's pick. Think of a pickaxe as a combination



A view of a variety of hard rock breaking, prying and moving tools, including drills, pry bars and other handy items.



Bullpins like this can be handy for opening up existing fractures in the rock to break material free.




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Chisels and a heavy hammer can be used to open up existing fractures in the rock to make way for moving material.

hammer, chisel and lever.

Homemade Chisels

A great chisel for excavating rock in tight spaces can be made by cutting a leaf spring from a car down to 12"-18" and sharpening one end.

Chisel Maintenance

Keep chisels sharp using an angle grinder with a flap disc or on a grindstone. Cool the steel frequently in water to keep it from overheating and ruining its temper. If the steel turns blue, it has been overheated. Also note that the struck end of a chisel will eventually "mushroom" or flatten out from heavy use. The loose, fractured edges should be ground off before they become a hazard.

About Pry Bars

A 4' to 6' long "pinch point bar" is an excellent tool for lifting and moving large masses of rock. It's possible for a 2-man team to lift and relocate a 1-ton boulder using a pair of these and some wooden cribbing. Do a YouTube search for "USAR pinch point lifting" to see

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some heavy rescue examples.

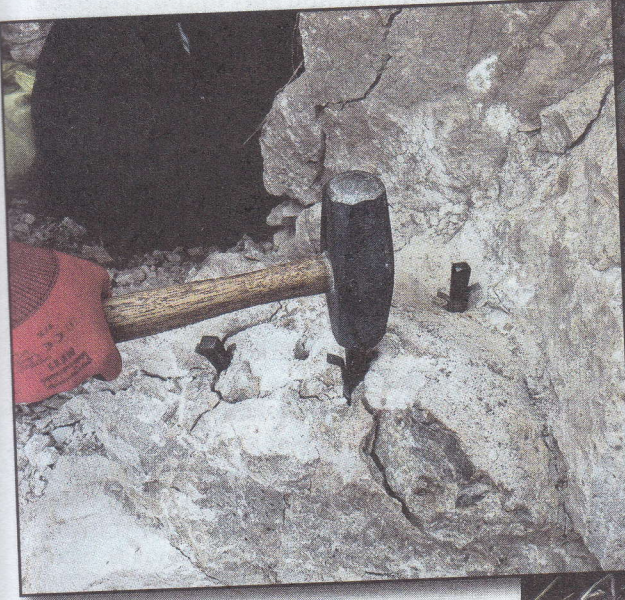
A long, heavy "digging bar" is a special type of bar that can be used for either prying rocks apart or dropping onto hard soil, such as caliche, to break it up. Hardrock is frequently mixed in with loose broken rock and hardpan, so you really need to be able to break and move both. Regular pry bars from 12"-36" are good for general prying. Use small stones to hold open cracks as you expand them.

A "scaling bar" is a lightweight prying tool with hardened steel picks on each end. It is available in lengths from 6 feet to over 12 feet long. It is used for "scaling" or "bar-

ring down" rock from the ceiling of an underground mine or a highwall. The main thing to remember is that a scaling bar must be used from a place where the rock cannot fall on you, and that messing with the ceiling or "back" of a mine can kill you if rock falls suddenly.

Feathers and Wedges

If you want to get more than just some small rock samples out, you really need to cleave the stone into blocks. Feathers and wedges are the way this is done mechanically. They come in sets designed for a specific hole size—anywhere from 5/8" to over



(Inset) The feather wedging process involves drilling a line of holes and then inserting a series of feather and wedge sets to create a force along the line of the holes. (Above) Keet and Tom work together to leverage the force of the pry bars to open up cracks and break the rock.



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2 inches. A feather/wedge set can break rock that is 4-6 times as thick as its length. So, a set that is 4 inches long can crack a 16"-24" slab of rock. One 3-part set is needed for each hole and one hole is needed every 6" or so. The basic steps are:

1. Drill a line of equally-spaced holes. Drill at least as deep as the longest part of the wedge set. Drill deeper if possible, especially if the material is very hard or thick. Holes can be drilled in a straight line or on an arc.

2. Place two steel feathers in each hole. The feathers should point in the direction you wish the rock to break.

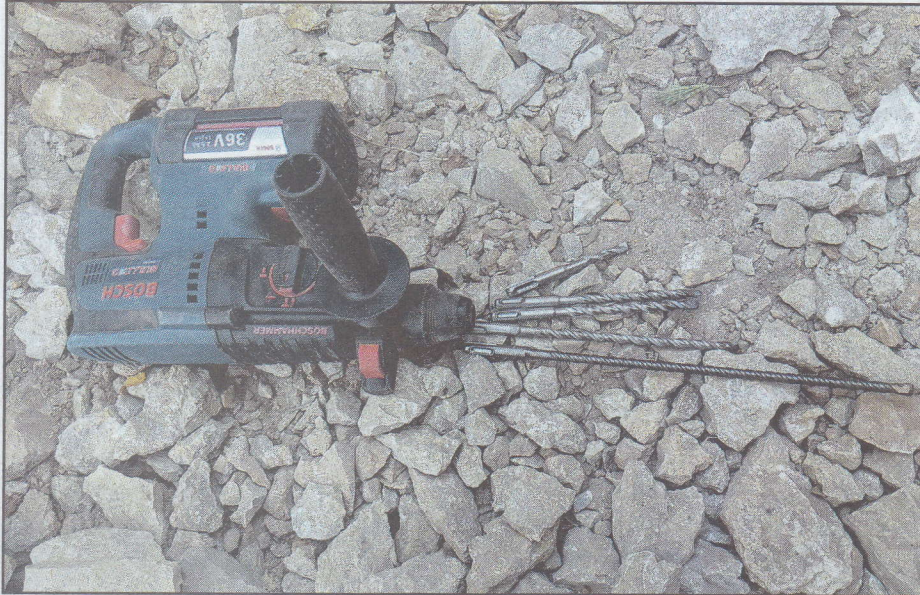
3. Grease the wedges and place in the center of each hole.

4. Begin tapping the wedges tightly into the holes with a single jack, double jack or a powered hammer.

5. Continue to tighten each hole until you see and feel cracks forming between the holes. Pause between each set of tightening and allow the rock time to crack.

6. When a continuous crack connects all of the holes and is starting to open easily, remove the splitting tools and insert one or more pry bars. Use caution and stay uphill, since the block could fall at any time!

Note that you may need to make multiple lines of cracks to remove a large block from a face. A free-standing boulder can often be broken in one pass with little prying. Blocks of rock the size of a small car have been quarried this way for centuries.



A portable hammer drill like this is an easy way to drill small diameter holes in rock.

Jackhammers

Electric, gas and pneumatic breakers can be used for mining a variety of materials. They are a faster and less laborious alternative to hammer and chisel, and many also have a drill mode. Jackhammers can be rented at any tool shop, along with a generator or air compressor if needed. Larger

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A close-up view showing how the wedge is inserted between the feathers to create a force on the rock as the wedges are hammered down. Man has been using this technique for thousands of years.

units are classified by the weight of the tool. Pneumatic tools are best if the intended work will include several hours per day of breaking. Electric and gas tools are more portable.

Like human-powered breaking, this method is great for digging through rock that is too hard for digging with shovels or a tractor but weak enough to fracture. The impact and vibration of a breaker can break pieces off of large slabs and make deep cracks for prying.

A variety of attachments are available:

1. Moil Point. The most common tool for general chiseling. Has a single sharp point, like a pencil.
2. Clay Spade. A heavy-duty, shovel-like attachment, suitable for cutting through hard soil and very soft rock.
3. Asphalt Cutters and Flat Chisels. Wider chisels are for softer rock and cutting up layered materials.
4. Rock Splitters. Large, power-driven feather/wedge-like tools. Usually used individually for boulder removal.
5. Drivers. These come in many shapes and sizes. They can be used to set T-posts, grounding rods, or pound on steel wedges.

All jackhammer/breaker tools have the ability to drive a tool up and down into the rock. Lighter-duty tools (especially cordless) and small electric hammer drills) should not be used for heavy prying. Use them only to make a pocket or start cracks. Larger industrial tools can be used to lever out rock as you cut. All jackhammers generate a lot of dust and high-intensity noise. Hearing and respiratory protection is mandatory. Many have specific maintenance instructions, such as oil ports or the need for in-line oiling if air-powered.

Hydraulic Splitters

Widely used in civil construction, the hydraulic splitter is another variation of the "feather and wedge" concept. It has a fixed set of counter-wedges and a hydraulically-powered moving wedge. The smaller 400-ton models can be handled with one hand. Models are available with up to 800 tons of splitting force, and the hydraulic power unit can be electric, gas or air-powered.

The required holes range from 1"-3" and up to 30" deep for the larger units. Once a crack has started,

progressively-larger counter wedges can be swapped into the unit until the desired breakage is achieved. Like conventional feather and wedge sets, multiple units can be used simultaneously with the proper hydraulic manifolds and hoses. These are an interesting, professional-quality tool that might be worth renting or acquiring if you are trying to remove museum-quality mineral specimen gold from a working mine, or need to extract other high-value material. If you are handy with fabricating equipment or

tractor implements, you could probably build something similar using a double-acting cylinder and appropriate attachments.

Concrete Saws

This is another specialty tool that might be worth using in some situations. Common sizes include 14" and 16" and they can be gas, electric, air or hydraulic. This tool uses a diamond blade to mechanically cut into rock. This could be a good way to separate a valuable specimen from the host

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rock or create deep slits for prying out blocks. I have seen this used to "grid up" an outcropping for breaking and removal.

Heavy-duty diamond-tipped chainsaws are also used in mining products such as Carrera marble. Some are so large that they must be

mounted to a skid steer or similar machine. Like most heavy construction tools, concrete-cutting saws can be rented from any serious tool shop.

Conclusion

Mechanical techniques can break and move rock. Mankind has been

mining this way for thousands of years, and the old ways still work. If you want to remove some ore with a minimum of upfront investment and surface disturbance, this will work for you. If the phrase "time is money" describes your situation, you'll probably want to look elsewhere, such as the expanding grout and small-scale blasting techniques we will be covering soon.

Happy mining!

The author 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 at: jnorman@accxproducts.com

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"Hard Rock University" YouTube channel www.youtube.com/channel/UCbcYhenGjjBC5GgEjEANLQ



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