Identifying quartzite, limestone and dolostone
and preparing dilute hydrochloric acid for use in testing

Quartzite, limestone and dolostone are all common in the Canadian Rockies, and they can look much alike. Here is how to tell them apart.

Quartzite in the Canadian Rockies is nearly all "orthoquartzite," a non-metamorphic form of quartzite in which grains of quartz sand are cemented together with microcrystalline quartz. Quartz (SiO_2) has a hardness of 7 out of 10 on the Mohs scale. It is harder than steel, which is 5 to 6. Quartzite is by far the hardest common rock type in the Canadian Rockies, which makes it easy to identify. Scratch suspected quartzite with anything made of steel, such as a knifeblade, and if no obvious mark is left on the rock—typically a gray streak of metal will be left—then it is probably quartzite.

The layer might be **chert,** which is also quartzitic. But chert lacks the obvious sand-grain content of quartzite, and layers of solid chert are rare.

If the layer scratches easily, it is not quartzite or chert. It might be siltstone, shale or slate, typically soft rock types that split into thin sheets and can be identified thereby. If the layer is not one of these, then it is probably limestone or dolostone. Limestone and dolostone have the same hardness (3 out of 10 on the Mohs scale, so they scratch easily), and they can look very similar.

Calcite, chemical formula $CaCO_3$, is the main mineral in limestone. **Dolomite,** chemical formula $CaMg(CO_3)_2$, is the main mineral in dolostone.

Hydrochloric acid (HCl) reacts with calcite to produce water, calcium chloride ($CaCl_2$, a salt) and bubbles of carbon dioxide gas (CO_2). Vigorous bubbling under HCl means that the specimen is practically pure $CaCO_3$, which calcite-vein deposits typically are and some limestones approach. Weaker bubbling means that there is less calcite and probably more dolomite, a mineral in which magnesium (Mg) has been substituted for some of the calcium. No bubbling means that neither calcite nor dolomite is present.

When in limestone/dolostone country such as the Canadian Rockies, any field geologist will have HCl on hand. It's important to test with acid of the right strength, meaning not very strong.[1] The solution I use works well for differentiating calcite and limestone from dolomite and dolostone. Here is how to mix up your own supply.

I make a litre of rock-testing acid at a time by diluting HCl with tap water, remembering to ***add the acid to the water, not the other way around.*** That's a general rule when diluting any acid.

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[1] In a pinch, ordinary vinegar is strong enough to react with calcite. But the reaction with dolomite is too weak to make vinegar very useful in determining which mineral is which.

- To 800 ml of tap water, add 120 ml of standard 20° **muriatic acid** (hydrochloric acid available in paint stores and used mainly for cleaning concrete), which is 31.5-percent pure HCl. This is much too strong for our purpose. Adding 120 ml of muriatic to 800 ml of water cuts the concentration considerably, to just the right strength.
- Be careful. Muriatic acid is strong enough to cause chemical burns. If you get this acid on skin or clothing, immediately rinse the spot with lots of water.
- If making a smaller amount of dilute HCl, use a ratio of seven to one, whether it's one drop of muriatic added to seven drops of water or one measuring-spoonful of muriatic added to seven measuring-spoonfuls of water.
- This dilution is stronger than vinegar, but it's not strong enough to burn the skin. Keep it out of your eyes, though. Treat contact by rinsing with water. Rinse any spots in which the acid has got on your clothing, or it will weaken the fabric. Don't get it on anything that has been chromed. HCl reacts with chrome and even at this mild strength will damage it. Plain steel and stainless steel are not affected.
- When placed on limestone that has a high percentage of calcite, a drop of this mild acid will react strongly, as shown in the photo, bubbling and even fizzing.
- When placed on dolostone the acid will react weakly, producing small bubbles. To ensure that you see any reaction that may occur, use a magnifying glass or scratch the surface to produce some powder. This provides a greater surface area on which the acid can work. When the acid is applied, the powder will become fuzzy and gray as myriads of small bubbles form in it.

I carry my rock-testing acid in a small squirt bottle that once held liquid Beano. This container is small enough to keep handy in my pocket when I'm out geologizing, and it seals well enough to keep the acid from dribbling out. The aperture is the perfect size for putting a drop or two onto the rock.

Avoid using a bottle with a swivelling nozzle that is supposed to seal when in the horizontal position. Such bottles typically leak.

Bottles with an eye-dropper in the cap are likewise suspect. Acid may escape where the bulb emerges from the cap, or the bulb may be cut. You need to use a bottle with a truly effective seal.

To get the acid into the bottle from my one-litre supply, I pop out the nozzle, squeeze the bottle, upend it and suck the liquid up into it. Then I pop the nozzle back in and rise the bottle off to ensure that no acid is left on it when it goes into my pocket. If I dribble acid onto the bottle during use, or if I suspect that some acid has escaped and might be remaining under the edges of the cap after it has been screwed on, I rinse the closed bottle.

— Ben Gadd, September 2008