Re: Quartz Origins (Uh−Oh, Another Geology Post)

Source: http://sci.tech−archive.net/Archive/sci.geo.geology/2009−01/msg00212.html

- *From*: Bruce Bathurst <bruce.bathurst@xxxxxxxxx>
- *Date*: Thu, 8 Jan 2009 22:18:24 −0800 (PST)

On Jan 8, 1:09 am, "Jean" <jean.len...@xxxxxxxxxx> wrote:

> Jo Schaper a écrit dans le message ...
>
> > Bruce Bathurst wrote:
> >
> > > On Jan 6, 12:36 pm, Jo Schaper
> > > <jo34schape...@xxxxxxxxxxxxxxx> wrote:
> > >
> > > > None of the dolomite in Missouri (unless it
> > > > is actually pink crystals)
> > > > is made properly, but I already know that, so
> > > > I use other ways to
> > > > determine what carbonate I'm dealing with.
> > > > *|:−)
> > >
> > > Jo,
> > >
> > > The oxalic acid crystals I used may occasionally have been
> > > citric acid
> > > crystals − whichever was available at the time. Truly, I never
> > > carried
> > > a plastic bottle of dilute hydrochloric acid on my belt, which
> > > always
> > > seemed excessive.
> >
> > As I noted somewhere else in the thread, I just carry a old OTC nasal
> > spray bottle with HCL clearly marked on it, I double bag it in ziplocks,

and it's in the pack, not on my belt. Never had an issue with it, since that tiny squeeze spray hole is going to drip at best, even if the screw on cap came off.

> However, this requires practicing with various known carbonate
> minerals before leaving for the field. You alluded once before to
> powdered dolomite not fizzing in an appropriate acid. This I've never
> encountered nor heard of; and it is important to geologists. I have no
> explanation, other than it's being a different carbonate. If it didn't
> fizz when powdered, how did you identify it as dolomite?

Most of my field work is done in Paleozoic (Cambrian−Mississippian, occasionally Pennsylvanian) carbonates which are an insane mix of of limestones, secondary dolostones, mudstones and thin crumbly shales. The sandstones are pretty discrete; but the other three sometimes interlayered and gradational. For the most part, the rock units around here are named as Potosi Dolomite, St. Louis Limestone, etc., so you would think knowing what unit it is in would be diagnostic, but because the dolostones are of the replacement variety, actual lithology varies quite widely. It is fairly easy to tell the limestones from the dolomites by texture; once you get the sparry limestones out of the mix, most of the limestones (grading into mudstone) are powdery, and rather soft; the dolostones are gritty, compact and generally harder. What confuses things even more are those incompletely dolomitized; it's not that unusual to have fossils retained in the dolomite−− i.e. the rock will not fizz, it's not shaley or muddy, but is carbonate and has fossils in it. I've also picked out limestone exposures in putative dolomites−− the book and the map says it should be dolomite, but it fizzes like crazy. What prompts me to test such rock? Its texture and eyeball muddiness.

I'm sure this method is non−scientific, and I don't expect it to work in an unfamiliar area, so I'm not advocating it. But that's what I like about geology−− every time you put information in little boxes, some of it thumbs its nose at you and does the Nah−Nah−Nahnahnah! dance.

Jean,

Alright, I'm pulling out my definitive reference:

http://saltthesandbox.org/rocks/namesrocksall.htm

Bruce

PS. Though irrelevant after Joe's recent information, I'll offer some references for identifying carbonates in the field. I must say that I've not a clue as to what Dr Findlay is writing of, except his fear of iron spears; but I'd be pleased if Joe looked only at the rocks (and showed a photo of the books of mica). One thing I can safely conclude: none of the following will help Joe a whit. Some geology students might find it of interest, though.

> Standard for geologist worldwide is a 10% solution of HCL.

The World agrees upon something? Thank God!

'If necessary almost any acid may be used, such as vinegar (acetic acid) or lemon juice. For field use a few crystals of citric acid powdered up may be conveniently carried and dissolved, when needed, in a little water; the text for effervescence can thus be readily made.'
Louis Pirsson, 1913.

> A 1 molar concentration which is sometimes used in soil science will generally not react with dolomite.

This is also what is commonly referred to as 'cold, dilute hydrochloric acid' in the older literature. It will generally not react with dolomite, unless one waits a very long time. One molar HCL solution is common among geologists and soil scientists for identifying calcite or aragonite. Any carbonate that didn't fizz was just a 'non−fizzing' carbonate. The fact that carbonate fizzes in 3 M. HCL only when powdered does not make it dolomite. One molar HCL was my choice for student laboratories.

<SNIP>

> Household vinegar used drop wise on limestone will not work (as a rule) it must soak the sample. Just to make sure I tried using fresh lemon juice on a almost pure limestone sample with no visible results.

Two textures of carbonates present problems using the fizzy test. Porous carbonates, such as amorphous smithsonite, reportedly absorb the acid and hide its reaction. Crystal faces with large surface tensions against the acid, such as dolomite or siderite, reportedly create spheres of some liquids, which it repels.

> I would be curious to know where in the literature is the use of oxalic acid crystals recommended.

In the past, citric acid granules, oxalic acid granules, and tartaric acid granules were used. Each has advantages and disadvantages. Oxalic acid, for example, offers the ability to identify several carbonates by the colors of their reaction products.

Available free from Google Books:

Bolton, H.C., 1877. Application of Organic Acids to the Examination of Minerals. Ann. New York Acad. Sciences, v.1, art. XV, p.1−152.

Bolton, H.C., 1882. Min. Mag. and J. Min. Soc. Great Britain & Ireland, v. 4, Art. 12, p. 181−188.

Richards, J.W., & N.S. Powell, 1900. Substitutes for Hydrochloric Acid in Testing Carbonates. J. Am. Chem. Society, p. 117−121.

Addendum 2 and some other information was taken from Bolton, 1877.

<SNIP>

> Scientific discussion: Upon reaction with 10% hydrochloric acid, ... Geologists use this behavioral difference as a field test to discriminate between ...http://www.mii.org/pdfs/An_Acidic_Reaction.pdf

Some geologists. :−) Citric or oxalic acid crystal behave similarly. However, here's an article on the use of 1 M. HCL, also recommended (I think) by Weinschenk, E., 1912. Petrographic Methods. (Anleitung zum Gebrauch des Polarisationsmikroskops; Die Gesteinsbildenden Mineralien, trans. R.W. Clark) NY: McGraw−Hill.

http://soils.usda.gov/technical/technotes/note5.html

> Someone reminded me that in the USA often the muriatic acid is sold as 22 degree baumé . This is 36% (11.64) molar . To get 10% (2.87M) add 258 ml of the 36% acid to distilled water then dilute to 1000ml. If you have Chemical company concentrated HCl that will be 12 molar. For a 3 molar concentration (close enough for field work) just dilute by a factor of 4 or 250 ml in distilled water then diluted to 1000ml.
>
> JL

I'm not sure it makes much difference. The term 'dilute hydrochloric acid' in the geological literature referred, I believe, to concentrations between 0.2 and 2.0 molar, as opposed to 3.0 molar 'hydrochloric acid'.

The literature still claims Joe can use lemon juice or white vinegar. :−)

Addendum 1: Advantages of granules of organic acids.

'Diducit scopulos et montem rumpit aceto.' This was the claim than Hannibal used vinegar to dissolve boulders in his path over the Dolomites, to Rome. Those who used hydrochloric acid included Geikie and Peach, Horne, and Clough of the Scottish Highlands. Those who preferred acetic acid included Pirsson at Yale, and Iddings at Chicago. Those who recommended either included the USGS.

Citric acid crystals were the choice of a few odd people

'For field work and travel, it is well to appreciate that a few dry crystals of citric acid, that can be dissolved in a little water as needed, serve very well for tests of effervescence. They are more safely carried than are liquid mineral acids.' J.F. Kemp, 1908

'It is clear that in rough hill−work it is better to carry a flask of water and the dry citric acid than to risk the fracture of a bottle of hydrochloric acid in the pocket.' G.A.J. Cole, 1902

The crystals saturate the water drop and acted as 3 M. HCL would, except it took longer for the dolomite to fizz. This could be an advantage when one needed to see exactly which crystals were fizzing and which not.

Saturated oxalic acid or tartaric acid behaved similarly with aragonite, calcite, and dolomite, but had the advantage of producing reaction products that were characteristic of the carbonate being dissolved. Oxalic acid crystals are used for bleaching wood, and tartaric acid for baking scones.

Oxalates

Saturated oxalic acid, for example, produced light yellow crystals on powdered ankerite, feathered needles on barite, heavy white crystals on witherite, greyish−green on malachite, and bluish−white on azurite.

Tartrates

Saturated tartaric acid produced spherulite stars of acicular crystals on barite, and long, delicate, almost capillary needles in parallel bundles on witherite.

Field Microscopy

Tartaric and other organic acids I've not used. I've noticed that both Olympus Camera Company and Mattel Toy Company produce small, digital, polarizing microscopes, which may again bring oil−immersion microscopy into the field. Even then, it is difficult to optically distinguish aragonite, calcite, and dolomite.

Wet chemical tests

Deer, Howie, & Zussman still recommend Meigen's test to distinguish aragonite from calcite, and Lemberg's test to distinguish calcite, magnesian limestone, and dolomite. These are described in standard references.

Addendum 2. Solubility of common carbonates in various acids

1 = mineral effervesces quickly when acid dropped on smooth surface
2 = feebly & slowly attacked
3 = do not effervesce

Comparison of dilution with Hydrochloric Acid and saturation with Citric Acid Crystals
HCL sp=1.055 Saturated Citric Acid

calcite 1 1
azurite 1 2
witherite 2 1
strontianite 2 1
barytocalcite 2 1
malachite 2 1
ankerite 3 2
smithsonite 3 2

dolomite 3 3
magnesite 3 3
siderite 3 3
rhodochrosite 3 3

Saturated Oxalic Acid

calcite 1 $CaCO_3$
witherite 1 $BaCO_3$
strontianite 1 $SrCO_3$
cerussite 1 $PbCO_3$
barytocalcite 1 $BaCa(CO_3)_2$
magnesite 1 $MgCO_3$

dolomite 2 $CaMg(CO_3)_2$
ankerite 2 $Ca_2MgFe(CO_3)_4$

rhodochrosite 2 $MnCO_3$
smithsonite 2 $ZnCO_3$
malachite 2 $Cu_2(OH)_2CO_3$
azurite 2 $Cu_3(OH)_2(CO_3)_2$
siderite 2 $FeCO_3$

Saturated Tartaric Acid:

calcite 1
witherite 1
strontiahite 1
cerussite 1
barytocalcite 1

dolomite 2
ankerite 2
rhodochrosite 2
smithsonite 2
malachite 2
azurite 2

magnesite 3
siderite 3

−bb

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