MICROMOUNTERS OF NEW ENGLAND

The MMNE was organized on November 5, 1966 for the purpose of promoting the study of minerals that require a microscope.

March 1991 Newsletter #148

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Dues are $6.00 per year and are due on January 1st, payable to the Treasurer

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Contributions of news items for the Bulletin are welcome and should be sent to the Editor.

This bulletin may be quoted if credit is given. Club address is c/o Editor.

NEXT MONTH

The next meeting of the MMNE will be Saturday, April 6th, at the Sudbury Public Library.

Our next meeting of the MMNE will be on Saturday, March 9, 1991, at the Auburn Public Library. Bob Janules will present a short slide program entitled "A Newcomer's view of Mont Saint-Hilaire."

Welcome New Members:

Mary McCann
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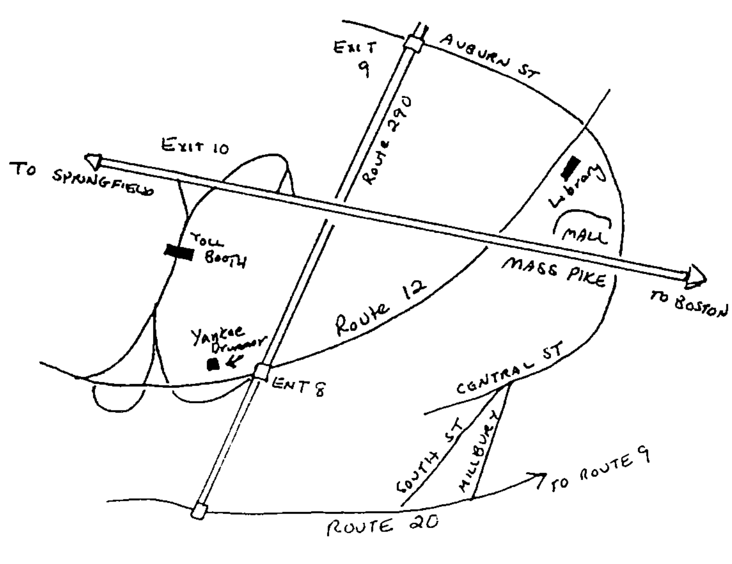
Dues are now Past Due! Please check your mailing label to see if we have recorded you as remitting your MMNE dues. If we have you listed as yet unpaid, a red **"D"** will appear on the mailing label on your envelope. As always, we remind members that some overlap may occur, between the time of dues remittance and bulletin mailing. However, we make every attempt to keep our records up to date.

In this issue, we will be completing our article concerning the cleaning of minerals. And, for those of you who have escaped the snow this winter, we are including an article on snow crystals!



Solubility Table for Minerals

MINERAL	SOLUBLE IN:	MINERAL	SOLUBLE IN:
Actinolite	HF	Datolite	HCl
Adamite	Any acid	Diamond	Insoluble
Aegerine	HF	Diaspore	Insoluble
Alunite	HCl	Diopside	HF
Amalgam (native)	HNO_3, H_2SO_4	Dioptase	CH_3COOH
Amber*	Alcohol	Dolomite	HCl
Analcime	HCl	Dufrenite	HCl
Anatase	Insoluble	Dyscrasite	HNO_3
Andalusite	HF	Enargite	HNO_3
Anglesite	HNO_3, KOH	Epidote	HCl
Anhydrite	HCl	Epsomite	Water
Annabergite	Any acid	Erythrite	HCl
Antimony (native)	HNO_3	Fluorite	H_2SO_4
Apatite	HCl, H_2SO_4	Franklinite	HCl
Apophyllite	HCl	Galena	Strong HNO_3
Aragonite	Any acid	Garnet	H_2SO_4
Arsenic (native)	HNO_3	Garnierite	HCl, H_2SO_4
Arsenopyrite	HNO_3	Gibbsite	Strong H_2SO_4
Asphaltum	Alcohol, Turpentine	Glaucophane	HF
Atacamite	Any acid	Goethite	HCl
Augite	HF	Gold (native)	Aqua Regia
Axinite	HF	Graphite	Insoluble
Azurite	HNO_3	Greenockite	HCl
Barite	Hot H_2SO_4	Gypsum	HCl
Benitoite	Insoluble	Hematite	HCl
Beryl	HF	Halite	Water
Biotite	H_2SO_4	Harmotome	HCl
Bismuth (native)	HNO_3	Hausmannite	HCl
Bismuthinite	Hot HNO_3	Hauyne	HCl
Boracite	HCl	Hemimorphite	HCl
Borax	Water	Heulandite	HCl
Bornite	HNO_3	Hornblende	HCl
Boulangerite	Hot HCl	Hydrozincite	Any acid
Bournonite	HNO_3	Idocrase	HCl
Braunite	HCl	Ilmenite	HCl
Brookite	H_2SO_4	Ilvaite	HCl
Brucite	Any acid	Iridium	Insoluble
Calcite	HCl	Iron (native)	Any acid
Carnallite	Water	Kaolin	H_2SO_4
Cassiterite	Insoluble	Kyanite	Insoluble
Celestite	Insoluble	Lapis Lazuli	HCl
Cerrusite	HNO_3	Laumontite	HCl
Chabazite	HCl	Lazulite	H_2SO_4
Chalcanthite	Water	Lead (native)	HNO_3
Chalcocite	HNO_3	Leucite	HCl
Chalcopyrite	HNO_3	Limonite	Any acid
Chlinochlore	H_2SO_4	Linnaeite	HNO_3
Chloanthite	HNO_3	Malachite	Any acid
Chromite	Insoluble	Magnesite	HCl
Chrysoberyl	Insoluble	Magnetite	HCl
Chrysocolla	Any acid	Manganite	HCl
Chrysotile	HCl, H_2SO_4	Marcasite	Strong HNO_3
Cinnabar	NaOH	Mercury (native)	MNO_3
Cobaltite	HNO_3	Millerite	HNO_3
Copper (native)	HNO_3	Molybdenite	HNO_3
Cordierite	Any acid, very slow	Monazite	HNO_3
Corundum	Insoluble	Muscovite	Insoluble
Covellite	HCl	Natrolite	HCl
Crocoite	Any acid	Nepheline	Any acid
Cryolite	HCl, H_2SO_4	Niccolite	Any acid
Cuprite	Any acid	Olivine	HCl

Orpiment	NaOH	Sodalite	HCl
Orthoclase	HF	Sphalerite	HCl
Penninite	HCl, H_2SO_4	Sphene	H_2SO_4
Pentlandite	HNO_3	Spinel	Strong H_2SO_4
Phenakite	HF	Spodumene	Insoluble
Phillipsite	HCl	Stannite	HNO_3
Plagioclase	Any acid	Staurolite	HF
Platinum (native)	Hot Aqua Regia	Stibnite	HCl, HNO_3
Polyhalite	Water	Stilbite	HCl
Prehnite	HCl	Strontianite	HCl
Prochlorite	HCl, H_2SO_4	Struvite	Any acid
Proustite	HNO_3	Sulphur	CS_2
Psilomelane	HCl	Talc	HF
Pyrargyrite	HNO_3	Tellurium (native)	H_2SO_4
Pyrite	Strong HNO_3	Tetrahedrite	HNO_3
Pyrolusite	HCl	Topaz	Strong H_2SO_4
Pyromorphite	HNO_3	Tourmaline	HF
Pyrophyllite	H_2SO_4	Tremolite	HF
Pyrrhotite	HCl	Tridymite	HF
Quartz	HF	Turquoise	HCl
Realgar	NaOH	Uraninite	HNO_3, H_2SO_4
Rhodochrosite	HCl	Vanadinite	Any acid
Rhodonite	HCl	Vivianite	HCl
Rutile	Insoluble	Witherite	HCl
Sanidine	HF	Wolframite	HCl
Scapolite	HCl	Wollastonite	HCl
Scheelite	HCA, HNO_3	Wulfenite	HCl, HNO_3
Serpentine	HCl, H_2SO_4	Wurtzite	HCl, HNO_3
Siderite	HCl	Zincite	Any acid
Sillimanite	HCl	Zinnwaldite	HCl
Silver (native)	HNO_3	Zircon	Insoluble
Smaltite	HNO_3	Zoisite	Hot HCl
Smithsonite	HCl		

Suggested procedure to clean a specimen

Study the solubility table, find which chemical will affect the unwanted mineral, then cross check that the chosen chemical will not have any effect on the desired specimen. If it is found that the mineral will be affected, use either a weak solution, or else dip the specimen briefly, inspect again, then note the results. When there is any doubt, do a small piece, study it thoroughly, and note the result. Now modify the method, or else leave well alone. Get into the habit of writing down the result of every treatment, chemical used, whether cold or hot, weak or strong, time of immersion in the solution, in fact, every possible thing that was done to the specimen.

Remember, play it safe; try small bits first; keep a record; then tell your friends. Happy results. -- E. L. Steyn

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Piles of Microcrystals
by Dana Morong

Imagine literal piles of such tiny crystals, so many that most folks just throw them away. What a paradise for a micromounter. Even if they are all of the same species, each one is unique, as crystals generally are. Where can one find such specimens? One man found a great deal of then in Vermont, although that is not a state renowned for its microscopic crystals. Also, he found them in the off-season. At least that gives something to keep one busy then, anyhow.

Wilson A. Bentley was one such collector of microcrystals, and he started when young. Although economically poor, his mother recognized her son's interest in nature, bought him a microscope, and then, when he discovered snow crystals, he was launched upon his life's work. He eventually persuaded his father to buy him photographic equipment and a microscope to use it with, and recorded these delicate crystals on film. Each winter he recorded weather conditions, correlating that with the type of crystals that fell in his yard (didn't have very far to collect, did he?). What other were shoveling aside in masses, he studied. He was a farmer in warm weather, an "off-season" for him!

Whereas those getting on in years are counseled to exercise in moderation, shoveling a lot of rock is definitely overdoing it. Micromounters, though, don't generally have to dig deep for their finds, fortunately. Though usually only of one mineral, snow and ice do constitute a rock, at least when they are compact. Shoveling rocks is a bit much for some folks, so they use equipment, heavy equipment, to move it. It may have a specific gravity of 0.92 at its hardest, but it all adds up!

Snow and ice are but varietal names for water, a certain species of mineral. A mineral is defined as a natural inorganic substance of a definite chemical composition, and this certainly does fit this definition. The composition of snow is, of course, hydrogen oxide, both lightweight elements. Water (and its forms) is said to be of the most unusual, chemically and physically speaking, compounds on the Earth, although abundant. Several of its properties are unique, not the least being that its solid form has a lesser density than its liquid form. Palache, Berman, & Frondel, in the System of Mineralogy, say that "compared to other liquids, the specific heat, surface tension...and dielectric constant is abnormally high; the electrical conductivity is very low" (-page 495). And while it can't dissolve everything, many substances are soluble in water, either alkaline, neutral, or acidic, and usually more so when heated. Thus water has been said to be the universal solvent.

Not every snowstorm deposits fine crystals - many in fact do not. Sometimes there are ice pellets, other times clumps of snow, or often imperfect crystals. Drier, cooler and calm conditions can create good crystals, though. The sparkling of the snow is due to the many tiny facets reflecting, or at times refracting, the sunlight or moonlight.

I once saw a large frost crystal, nearly an inch across (part of a hexagonal plate) in the entrance of an animal burrow. Although probably of organic origin, the water vapor sublimed upon a root branchlet that was protected from the wind. In cold conditions the molecules tend to collect upon the prisms, and so the crystal grows platelike. This is in common with crystals whose fastest growing faces tend to grow themselves right out of existence! The basal face attracts little attention from the molecules and so gets larger and larger!

For the past couple of winters, I kept one room cool to allow frost designs to form on the window. During the day the sun evaporated the moisture caught between the storm and inside panes, but upon cooling at night, the dendrites can form. I have seen half of the lower pane covered with a fern pattern similar to that of Boston ferns, with thick stems, regularly spaced spore-sacs along the stem, and fernlike to feathery growths branching off. Other windows have not the correct conditions, and hence give no delicate frost growths.

The unfortunate aspect of snow crystals is that one cannot conveniently enjoy these year round (at least not in New England). I have seen some in the summer, crystals in the sides of an ice-cream freezer in a grocery, but these don't get the chance to grow very big, and one can't take them home. Wilson Bentley, however, would catch snowflakes upon dark velvet and photomicrograph these with his chilly equipment, eventually getting thousands of plates of crystals over the course of his lifetime. Some of these have been collected into an atlas which is valued as a classic reference (although it contains no color plates, but only black and white). He probably saved some original crystals in a freezer, but they are probably lost by now.

Actually there is another way to preserve the crystal patterns for later study at room temperature. It is by catching them in a certain plastic dissolved in a solvent. When the solvent evaporates, it leaves an outline of the crystal pattern. This was discussed in an "Amateur Scientist" column in the March 1966 issue of Scientific American.

One book on the subject, once written for children, contains such a wealth of information and plates that, if it weren't for its title, it would be eagerly sought after by a few professors and meteorologists interested in old books on the subject.

"That snow crystal study is extremely fascinating is well shown, for Mr. Bentley declares that although he works out of door for hours at a time, when often his hands are well-nigh frost bitten...yet he is himself almost unconscious of discomfort...so keenly interested and intent is he at the time, in securing some new and wonderful type of crystal to add to his already large collection of snow jewels." - Thompson (1907), page 134.

Mr. Bentley collected not only snow crystals of platy habit, but also hexagonal prisms, frost patterns, and all sorts of different habits. He sometimes even found twinned crystals, as well as what we now call "phantoms" and growth patterns, and such.

> "Hast thou entered into the treasures of the snow?
> Or hast thou seen the treasures of the hail?" - Job 38:22

Additional Reading:

Bell, Corydon (1957), The Wonder of Snow, Hill and Wang, New York, 269 pages.

Bentley, W. A. & Humphreys, W. J. (1931) Snow Crystals, Dover Publications, 1962 edition has only 226 plates.

Borland, Hal (1971) "A Lifetime of Snowflakes", Audobon, January, pp. 59-65 (photos by Wilson A. Bentley).

Knight, Charles & Nancy (1971) "Hailstones", Scientific American, April, pp. 96-103

LaChapelle, Edward R. (1969) Field Guide to Snow Crystals, Univ. Of Washington Press, 101 pages.

Nakaya, Ukichiro (1954) Snow Crystals: Natural and Artificial, Harvard Univ. Press, 510 pages, over 1550 photos on 188 plates.

Strong, C. L. (1966) "The Amateur Scientist", Scientific American, March, pp. 120-126, (Vincent J. Schaefer discourses on catching snowflakes in plastic).

Thompson, Jean M. (1907) Water Wonders Every Child Should Know, (with photos by Wilson A. Bentley).

Walker, Jearl (1980) "The Amateur Scientist", Scientific American, December, pp. 231-238 (physics of patterns of frost on windows).