Mineral dealers at rock shows will occasionally offer specimens labeled enhydros for sale. What they are selling are typically quartz crystals with liquid inclusions. Within the liquid is a tiny bubble and if you tip the crystal back and forth the bubble will move. The dealers will often circle the bubble and if you cannot find the bubble, the dealer will spend a lot of time searching with you. Most require that you use a magnifier. So what are these things?

First of all they are fluid inclusions, not enhydros, and they are also much more common than you might imagine. I will define both, but here is how fluid inclusions form. Minerals grow by adding elements to their surfaces, edges, and corners. Quartz crystals grow in many environments, but they commonly form by growth out of a hydrothermal solution – hot ground water containing dissolved silica. Growth rates and mechanisms are complex subjects and some scientists spend years on this single area of research. It is enough for our purposes here to know that different parts of a single crystal or crystal face can grow at different rates. When this happens microscopic pits develop in the crystal faces. These become the vessels for our bubble bearing liquid. Think of the hopper shaped halite or copper crystals that you’ve seen or those deep cavities or the faces of some Brazilian quartz. As the crystal grows larger, the next layer or several layers of crystal growth can cover these pits trapping liquid in the process. Now the fun begins!

When a liquid is heated it expands, when it cools it contracts. Solids like quartz also expand and contract, but to a much smaller degree. An everyday example of expanding and contracting liquids is the liquid in a glass thermometer. The glass in a thermometer also expands and contracts, just not nearly as much as the mercury or colored alcohol in the tube. When our quartz crystal is finished crystallizing it cools down (and so does the liquid in the inclusion). The cooling liquid contracts and may pull away from the sides of its tiny quartz container forming a vapor bubble.

Scientists call these trapped liquids and their bubbles fluid inclusions. They are quite common and very fascinating. The white color of milky quartz is due to thousands or perhaps millions of microscopic fluid inclusions. Gemologists see inclusions when they look at certain gemstones (emerald is a good example) with a microscope. The liquid is not always water. A common fluid in ore forming processes is salty water. In general, hot water can dissolve a lot more salt than cold water can. Quartz growing in hot salty water may trap some of that salt water in inclusions. When the salt water in the inclusions cools and contracts, it too will form a bubble. But another interesting thing happens; because the water has cooled down it can no longer hold as much salt as it did when it was hot. Salt begins to crystalize out as a halite crystal within the fluid, which in turn is trapped in the quartz crystal. Imagine peering into a microscope and seeing an inclusion with a tiny vapor bubble and microscopic halite crystal! (micromounters eat your heart out.) Other things found in these fluid inclusions are carbon in fluids in Herkimer diamonds (doubly terminated quartz crystals from Herkimer, New York) and oil in fluorite from Elmwood, Tennessee. (Oil often fluoresces – check out your fluorite!) There are many more examples of wild stuff trapped in minerals (Roedder, 1972).

And let’s think about this for a minute: the fluid in the inclusion is an actual sample of fluid in which the mineral was growing! For this reason fluid inclusions are geochemical time capsules for scientists. Techniques have been developed to study these inclusions and determine their composition and the exact means of trapping (Roedder, 1962 and 1984). They tell us how minerals grow, how ore deposits form, and even guide us to oil or metal deposits. They also add or detract from the value of gemstones. And they are simply entertaining to watch. I have a large inclusion in amethyst from the pegmatites in Brandenburg, Namibia. You can see the inclusion through a prism face of the amethyst without a magnifier. The bubble will move around its triangular home in the amethyst when you rotate the crystal 360 degrees.
So what is an enhydros? The American Geological Institute’s Glossary of Geological Terms (Bates and Jackson, 1987) defines an enhydros as “a hollow nodule or geode of chalcedony containing water, sometimes in large amounts.” This is different from the fluid inclusions that we have been talking about thus far. Remember that chalcedony is a microcrystalline, fibrous variety of quartz. Chalcedony is made up of hundreds or thousands of tiny elongated quartz crystals. These fibrous crystals grow from ground water flowing through a rock, commonly basalt or other volcanic rock. The silica-bearing ground water begins precipitating quartz when it enters a cavity. The chalcedony may entirely fill the cavity forming a nodule or it may leave a void in the center to form a geode. If it forms a geode, then some of the remaining liquid may become trapped in the void. Everyone is familiar with geodes and we all know that the crystal-lined voids in the center can be several inches in diameter – they could hold a lot of water! Mineral dealers who sell true enhydros cut the water-containing geode so that they miss the center of the geode, which would release the water. If you see an enhydros it will look like a chalcedony nodule, but if you shake the enhydros the water will move around.

Scientists call the quartz with moving bubbles fluid inclusions. That is what they are and that is what we should call them – fluid inclusions. Geodes with water are called enhydros. It would be better to call the things we see at gem shows “bubbles” than enhydros. Not a single article or book on fluid inclusions that I have seen even mentions the term enhydros.

There is a significant difference between enhydros and fluid inclusions. While enhydros may form by trapping water at the time they are formed, the walls of the geode are porous and water can leave or enter the enhydros. This happens in nature before we find and collect the enhydros. Ground water may continue to flow in and out of enhydros until we collect them, then water only seeps out. Some books warn that enhydros should be sealed to prevent leaking (not to worry, this process is very slow). This means that the water in the enhydros may not be the same water that was trapped when the geode grew (Matsui et al., 1974). Fluid inclusions trap water from which the mineral grew. The walls of a fluid inclusion are solid and non-porous. Only under special, but not completely uncommon, circumstances will a fluid inclusion leak (Roedder, 1984). The water in the fluid inclusion is commonly the water that was trapped when the crystal grew. Some scientists have examples of fluid inclusion dating back to the early Precambrian. That’s amazing. These Precambrian fluid inclusions may hold water that is over three billion years old!

Can fluid inclusions leak? Yes, but this happens rarely and typically if a crystal is fractured at some point. Careful examination of the crystals with a microscope can reveal clues as to whether a fluid inclusion is primary and has not leaked. Minerals that exhibit cleavage are more susceptible to leakage: calcite, barite, and fluorite for instance.

Enhydros are scientific curiosities; fluid inclusions are a scientific research tool. It’s sort of like the fluid equivalent of the difference between a rock and a mineral. It is incorrect to label a mineral with a fluid inclusion an enhydros. A label calling attention to the fact that a mineral bears fluid inclusions is correct and should even increase the value of a specimen because of the scientific value and unique circumstances under which these formed. Now get busy changing those labels!

References:


Several weeks ago I attended a meeting of the Northwest Georgia Mineral Society. I was told of two instances where people were arrested, fined or lectured by rangers on collecting in our National Forests. After many phone calls I found someone who had information on collecting.

For years the National Forest Service has considered collecting as recreation as long as hand tools are used, no trees are dug up or burned, and no streams were silted. The person whom I spoke with assured me that nothing has changed. Printed here is a paper from the National Forest Service concerning collecting on their lands. It might be a good idea for each of us to keep a copy in our glove compartments if there is ever any question as to our activities.

Rockhounding on National Forest Land
Southern Region U.S. Forest Service
[FS-6200-28 (7-82)]

A rockhound is an amateur who hunts and collects rocks and minerals as a hobby.

A wide variety of sedimentary, metamorphic, and igneous rock types are found within the National Forests of the Southern Region of the U.S. Forest Service. Many individual minerals are found in association with the rocks.

As a rule, there is no objection to taking a handful of rock, mineral, or petrified wood specimens from the surface of National Forest lands. No fee, special permission, or permit is required as long as the specimens are for personal, non-commercial use; no mechanical equipment is employed; no significant surface disturbance results; and collection does not conflict with existing mineral permits, leases, claims, or sales.

There are many areas scattered throughout the Southern Region where the United States owns the surface of the land, but does not own the minerals. There is no objection to collecting specimens of the local rock types exposed on the surface; however, mineral specimens which may have some value cannot be collected without permission from the mineral owner(s). These areas can be identified from maps in Supervisors' and Rangers' offices.

Rockhounding must not be confused with commercial mineral activities. Mining and mineral leasing laws are applicable to all activities of a commercial nature. During the course of collecting rock and mineral specimens, the rockhound may feel that a certain area is worthy of detailed exploration to determine whether or not a mineral is present in commercial quality and quantity. This type of detailed exploration can be conducted only under a Forest Service or Bureau of Land Management (BLM) permit.

Included with rockhounding is panning for gold in the beds of many streams crossing National Forest land. Stream-bed placer gold, in most cases, does not exist in sufficient quantity to constitute economically recoverable deposits. Ordinarily, no more than a few cents worth of gold can be panned per hour; however there is always a chance of finding the stray nugget or odd pocket of finer gold. The Southern Region allows gold panning in the beds of most streams crossing National Forest lands. No fee, special permission or permit is required as long as only shovel and pan are employed and no significant stream disturbance results. On National Forest land, where the minerals are privately owned, panners should obtain written permission from the mineral owner(s) prior to beginning.

As a rule the Forest Service gives consideration to the use of suction dredges for “vacuuming” gold from the stream beds on an individual case basis. Dredges with suction inlets 3” in diameter or less are usually considered non-commercial, and within the purview of rockhounding. Dredges with inlets larger than 3” are, with few exceptions, considered by the Forest Service to be commercial equipment outside the scope of rockhounding.

On National Forest land where the minerals are owned by private parties, the owners of the gold, or their designated agents, after providing proof of ownership, may employ dredges with inlets 3” or less without restriction as long as no significant disturbance results. Employment of dredges larger than 3” should be evaluated through an operating plan as other commercial mineral related activities on non-Federal minerals are evaluated.

Some tracts administered by the Forest Service are known as Public Domain Land. For the purpose of exploring the surface for minerals these lands are, to all practical effect, found only in Arkansas. Exact locations are recorded in the Supervisors’ and District Rangers’ offices of the Ouachita and Ozark National Forests, and the Regional Office in Atlanta, Georgia. The public enjoys special (statutory) rights to explore (and mine) for minerals on this category of land. If exploration will result in no significant disturbance, mining law and regulations allow the public to use mechanical equipment, such as dredges, without prior notification. It is best, however, to notify the applicable District Ranger’s office in advance to insure mutual agreement as to “no significant disturbance”.

In relation to mineral activities, disturbance is considered significant when:

1. Natural recovery would not be expected to take place within a reasonable period of time.
2. There is unacceptable air or water degradation.
3. There is unnecessary or unreasonable injury, loss or damage to National Forest resources.

(Continued on next page)
Additional details helping to define “significant disturbance” can be found in the Forest Service Manual (FSM) 2817.11 and Code of Federal Regulations (36CFR) 228.4.

Collectors, panners, and dredgers are advised to contact Forest Service offices about access to National Forest lands. Some areas may be readily accessible by family auto while others may be accessible only with difficulty by four-wheel-drive vehicles. Some roads may become seasonally closed. Remote areas may be accessible only by foot.

Forest Service District Ranger offices are the best sources for on-the-ground information relating to local access, road conditions, rest/picnic/scenic areas, camping, swimming, hunting, fishing, etc. These offices are open Monday through Friday, usually between 8:00 A.M. to 4:30 P.M. They are closed Saturdays and Sundays. A call to the applicable Forest Supervisor’s office will provide the address and phone numbers of District Rangers’ offices. Maps identifying National Forest land are available at Supervisors’ and District Rangers’ offices. Forest Service offices do not keep information on minerals or collecting localities. The best sources for such information are State Geological Survey offices, University geology departments and libraries, mineralogical societies, rockhounding and lapidary clubs, etc.


(GMS member Doug Daniels has obtained additional information from various Internet sites. This information will be provided in next month’s issue of Tips and Trips.)

The American Federation of Mineralogical Societies (AFMS) 2003 All American Club Awards

The All American Club Awards program was a great success this year, thanks to five Regional Federation Committee Chairpersons who coordinated the submittal of a total of fourteen entries for comparative evaluation to determine which Club/Society is one of the best in the American Federation of Mineralogical Societies. The 2003 All American Awards Club/Societies entries by each of the five participating Regional Federations were as follows:

**South Central Federation of Mineral Societies (SCFMS)**
- Tri-City Gem & Mineral Society (Temple, Tx.),
- Arlington Gem & Mineral Club (Arlington, Tx.),
- Waco Gem & Mineral Club (Waco, Tx.),
- Pine Country Gem & Min. Soc. Of Deep East Tx. (Jasper Co. Tx.),
- Austin Gem and Mineral Society (Austin, Tx.),
- Rocky Mountain Federation of Mineralogical Societies (RMFMS)
  - Colorado Springs Mineralogical Society (Colorado Springs, Co.)

**California Federation of Mineralogical Societies (CFMS)**
- Sutter Buttes Gem & Mineral Society (Marysville, Ca.),
- Roseville Rock Rollers (Roseville, Ca.),
- Fossils For Fun Society (Sacramento, Ca.),
- Eastern Federation of Mineralogical & Lapidary Societies (EFMLS)
- American Fossil Federation (Falls Church, Va.),
- Southeast Federation of Mineralogical Societies (SFMS)
  - NONE
- Northwest Federation of Mineralogical Societies (NFMS)
  - NONE

Large and small club/societies All American Awards were handed out at the AFMS Awards Banquet, held in Ventura California, on June 7, 2003. Gold medals were awarded to clubs with scores of 90+ points, silver medals were awarded to clubs scoring 80-90 points, bronze medals were awarded to clubs scoring 70-79 points, and Honorable Mention certificates were awarded to the remaining contestants. Trophies were also awarded to the highest scoring large club (100+ members) and highest scoring small club (<100 members). The awards presented were as follows:

**Large Clubs**
- Gold Medal: Midwest Mineralogical & Lapidary Society, Colorado Springs Mineralogical Society, Arlington Gem & Mineral Club, and Austin Gem & Mineral Society (also highest scoring club), and

**Small Clubs**
- Gold Medal: Northwest Wisconsin Gem & Mineral Society (also highest scoring club),
- Silver Medal: Central Illinois Gem & Mineral Club, Sutter Buttes Gem & Mineral Society, and Fossils For Fun Society,
- Bronze Medal: Waco Gem & Mineral Club, and Pine Country G.M.S. of Deep East Texas, and

I believe that the Georgia Mineral Society could have a very successful entry in the AFMS 2004 All American Club Awards program, if an entry is sent in. We need to put a team together to make it happen. Remember that the period of performance is for the calendar year 2003, so we have until January 2004 to document our activities and accomplishments.

Respectfully submitted,
Frank Decaminada, AFMS Education-All American Committee Chair and GMS Member
### July 2003

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#### Safety in the Workshop

*by Bill Buckner*

There are several concerns that are safety issues in our workshops. They include use of flammable gases; acids and alkaline liquids; turning wheels, saws, buffers; dust, oil, and fog from cutting and polishing; adequate ventilation; cleanliness; posture while sitting or standing; eye protection; mixing chemicals; when to mask to protect against inhaling dangerous materials; where and how to store and move volatile materials; and how we arrange our shop.

I have recently moved from Clarksville to Hermitage, Tennessee. These above concerns have been high priorities on how I set up my shop at the new location. I have much less room than I had before, so I have tried to find a way to be safe and still be able to store what I need to store (about two and a half tons of rocks including fossils and slabs). I also need to be able to use 18-inch, 10-inch, and 6-inch saws. I have two cabbing machines, two flat lap machines, silver smithing materials, buffing equipment, four tumblers, wire wrapping materials, and assorted other equipment to arrange where they will be safe and effective and still fit into a small space.

### Safety First

1. Realize you are with a number of other friends who are also in a small area with you who could be injured if you bump them, so watch where you are going and what you are doing.
2. Realize that you are working with some electrical equipment which are spinning at a very high speed, driven by belts located behind or on the side of the equipment, so watch your fingers and clothes.
3. Realize that the diamond wheels and saw blades on our equipment will break the skin if you touch them with much pressure, so watch your fingers and hands. It is best to remove all jewelry from your hands and neck, along with any other loose clothes which could become caught in the equipment.
4. Realize that the dop wax and the heater can be very hot. If you touch the hot wax with a dry finger, it will stick to you and burn your finger, so use water on your finger to spread the hot wax along the stone. The heater we use to keep the wax hot will also be hot.
5. Realize that at times we use chemical materials like solvents and glue which could cause irritation to the eyes or even cause a fire in the room, so make sure the room is ventilated.
6. Realize that all our cutting equipment requires a liquid coolant be applied to the blade/wheel all the time it is being used. It will give off a mist of water or oil, so make sure you always wear an apron.
7. Realize when cutting either on the saw or wheels, you are removing small amounts of stone which when dry is dust, so “ALWAYS” make sure that the blade or wheel has water or oil applied to it. If you cut stones without a liquid agent, breathing the dust will be harmful to your health, plus you will damage the very expensive equipment.
8. Realize most of the stones we cut have very fine crystal structure and act a lot like glass when sawing and cutting causing little chips to fly in all directions, so “ALWAYS” wear some type of eye protection.
9. Remember, if in doubt, “ALWAYS” ask your instructor.
10. Remember, “ALWAYS” let your instructor know what you are doing.

*From Lodestar (SFMS Newsletter), May 2003*
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