Article

Identify Your Mineral Treasures

Part Two: Determinative Mineralogy

Learning how to establish or verify the identification of minerals can provide an added dimension of enjoyment to what, for many, turns into a lifelong pursuit, while at the same time help the collector avoid the pitfalls of collecting.

In the first part of this multi-part series I covered **Descriptive Mineralogy**, reviewing the general characteristics of each chemical class of minerals, and the geologic environments in which they are customarily found. Mastering that knowledge can take years of field and hands-on experience, but in the process, learning and becoming confident in these two arenas will greatly help in your pursuit to identify unknown mineral samples—whether found or bought—without necessarily having to resort to more elaborate, time consuming, destructive, and often inconclusive testing techniques.

More importantly, it will help prevent you from falling prey to erroneous (common) or outright fraudulent (rare) dealings with sellers who are often themselves not mineralogists or knowledgeable enthusiasts, but simply sell specimens as a business endeavor. They in turn could have been misinformed or misled into buying specimens wholesale without actually *knowing* what they were! As mentioned briefly in the previous issue, knowledgeable buyers can use this to their advantage, as I have often done (and may I mention, I do not find this to be unethical on your part in any way). "Buyer Beware" can just as well be rephrased as "Seller Beware!"

However, even when armed with extensive knowledge and experience, one can still be fooled! An excursion on eBay will inevitably bring you face to face with such dilemmas—or opportunities, depending on your perspective and experience. I have obtained aragonite offered as nepheline from China; crystals (very nice, I might add) of erythrite hawked as purpurite, which to the best of my knowledge has never

GML Publishing

a division of the

Mojave Natural Resources and

Lithologic Survey

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Discover Minerals

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a mineralogy journal reviewing the mines, mineral resources, and geological history of the Mojave Desert region

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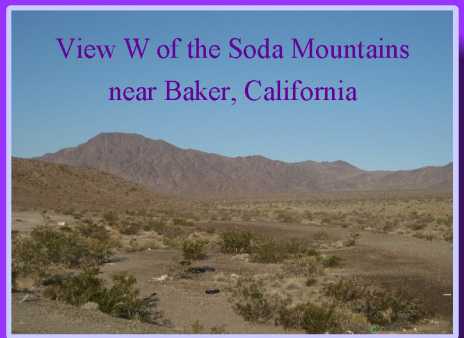


View W of the Soda Mountains near Baker, California

Examples of misidentified specimens sold on eBay

from left to right:

Descloizite (?) as Libethenite; Erythrite as Purpurite; Aragonite as Nepheline!

been found in free-standing crystals, but rather as large masses of a single crystal unit replacing lithiophilite; diatomaceous earth that was nothing more than massive calcite; and specimens labeled as libethenite that definitely are not, but still remain unidentified (possibly descloizite).

Rather than get mad over such transactions, simply identify the specimens correctly and add them to your collection. After all, they are still nice specimens, and probably would have been offered for far more money if the dealer knew what he actually had! Still, a friendly note *thanking* the dealer for the acquisition placates the ego!

Determinative Mineralogy is just as important when used in concurrence with your knowledge of the general characteristics of the various chemical classes. The first step every rockhound should perform before any expedition to the wilderness in search of specimens should be *research*. Before any trip, learn as much about the area and mineral deposits as possible. Just as you would not go without adequate water, supplies, and clothing, adding *knowledge* to the list will add greatly to a rewarding experience. Never venture into any unfamiliar territory unprepared!

Consulting a **geologic map** of the intended area will provide valuable clues as to what minerals you will likely encounter. Especially encouraging and productive will be areas where igneous intrusions (various shades of pink/orange on the map) contact carbonate sedimentary formations (shades of blue/purple). It is no coincidence that many mines will be found along these frontiers, for good reason. The final remnant of a solidifying intrusive magma will be hydrothermal solutions—very hot water saturated with elements that either did not participate in the rock-making process, or were left over excesses—that insinuate into the intruded strata. If those rocks are carbonate in nature, the hydrothermal fluids can easily dissolve the formation, allowing the ingredients from both sources to intermingle and form new minerals that precipitate into the intruded rocks forming veins and skarns, or completely supplant the strata as bedded replacement deposits. Both are ideal for the emplacement of valuable mineral deposits. Geologic maps can be found on the internet under the various state geologic surveys. Other sources include the BLM, private map stores, and local university bookstores that provide textbooks, references, and

supplies for their geology programs.

Topographic maps are also very useful. Mine locations are depicted and often identified by name, making it easier to look them up in mining books, such as geologic bulletins. Such maps also facilitate finding the locations more precisely. It is always best to look for minerals where they have already been found, rather than trying to locate virgin sources. In the heyday of mining (mid 1800s), the misfits of society—along with homesteaders and other opportunists—headed west in search of new lives and riches. Many spent their entire adult lives scouring every foot of every mountain range in every territory in quest of that pursuit. You're not going to find a deposit that they missed!

Other valuable sources of information include mineral science magazines, such as *Rock and Gem* and *Mineralogical Record*; journals such as the one you're currently reading; and the numerous trade shows that are proliferating just about everywhere. You will meet many knowledgeable people at such shows who are great sources of information one should not overlook. However, in today's technological world, the best research tool available is almost certainly the internet. Two of the most informative sites, though by no means infallible, are *mindat.org* and *webmineral.com*.

Once you've done your homework, gone out into the field, and returned home with specimens, it is then necessary to identify the ones you do not recognize.

Physical *versus* Chemical

There is no substitute for experience when it comes to mineral identification. However, no one can possibly know every mineral there is, nor everything about every mineral. Add to that Nature's propensity to pitch screwballs on every count, and you have a recipe for confusion and frustration. She doesn't like to do anything in purity, nor follow any textbook plan. This means even common minerals may not look familiar after crystal deformation, chemical contamination, weathered alteration, color tampering, or other tricks that can throw off even the most skillful collector! In such events, which happen more often than not, the best a collector in the field can do is decide whether or not the specimen is worthy of taking home for a closer inspection, and in doing so, decide on the most likely candidates, then try to eliminate as many contenders as possible. Thus the necessity to perform some kind of test to narrow the field.

Fortunately there are tools at your disposal to help in this chore, though not *all* will be practical for every specimen. For instance, a **hardness test** may reveal immediate results—unless, of course, the specimen is too small, brittle, or exhibits surface alteration. A test for **specific gravity** is useful only on pure specimens. Good luck with that! Same with **color**; though it can be definitive for some minerals (not so for most), even then alteration can affect what you see, not to mention that people see color differently from one individual to another. Even qualities such as luster, cleavage, fracture, tenacity, streak, et al, can be open to questionable interpretation. Nevertheless, you *have* to do something; staring at the specimen is not going to intimidate it into revealing its secrets!

Herein, **Determinative Tabels** have been devised by tedious development over decades of experimentation and observation. Such tables are of two kinds: those which rely chiefly upon *chemical* tests, and those which make use solely of *physical* tests. Since a mineral's chemical composition is its most fundamental property, those tables that emphasize chemical tests are the most satisfying. However, chemical testing can be a difficult and laborious task, and is certainly more expensive in

terms of cost of reagents and laboratory equipment (chemical testing will be addressed later in this series).

Conversely, tables that depend upon a mineral's physical properties have distinct limitations (as mentioned above) beyond which it is impossible to use them. Nonetheless, these tables do have the important advantages that their tests are simpler, quicker, more easily performed, and do not require laboratory equipment. For these reasons, physical determinative tables are more widely used than those that require chemical tests. For those collectors with the means, patience, and will, both used in conjunction will provide the most definative results.

Open your internet browser and type in "mineral determinative tables" to find sources you can use. Books containing tables can be found at mineral trade shows and used-book shops. Also check out webmineral.com's *Minerals by Physical and Optical Properties Tables*.

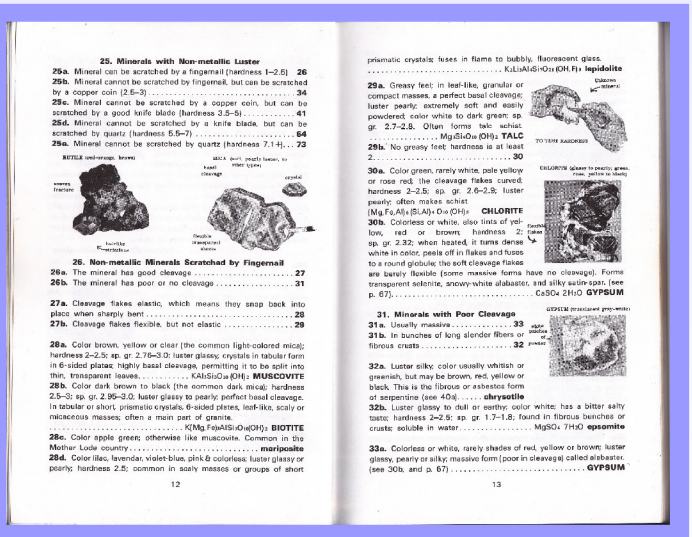
Typical tables are binary in structure, beginning with a mineral's most obvious characteristic (usually), its luster. For example, if the specimen is metallic, you will be directed to a certain section; if non-metallic, then you'll move on to a different section. With each alternative, a specimen will display either this or that possibility, and you will continue through the table until finally you reach only one candidate that matches all the previous choices.

Sounds simple enough, until you reach the inevitable stumbling blocks. Is that a cleavage you see, or just a crystal face? Is that streak black, or dark brown-black? Was that specimen scratched, or just broken? Each choice can lead down the road to a entrant that just doesn't match your specimen exactly! So many uncertain choices, until you're finally left scratching your head.

The best you can do is make a choice and live with it until other evidence presents itself to warrant a reconsideration. Don't feel bad. Every collector has specimens in the collection that are labeled as being one thing, when actually are something else! Sometimes years go by before finally things are made right. But if you've done your homework before diving into the wilderness, researched what minerals have already been found in the area, and collected specimens that can be narrowed down to a few candidates with fair certainty, then there's no reason not to be content with an honest guess. Sooner or later, you'll meet someone who knows for sure, find a reference from another source, or you'll have gained better experience to recognize your earlier mistakes.

Just remember, it is part of the game—the thrill and frustration—of acquiring unknown specimens, and then trying to figure out what they are, and eventually, making the right identifications!

Next issue will review the actual physical characteristics and the testing techniques to ascertain the likely identity of an unknown mineral specimen.



Example of a binary mineral identification table from *Rocks and Minerals of California* by Brown, Allen, and Stark, 1995