# CRAZY CALCITE

## Crystal-forming Confusion in Calcium Carbonate

Story and Photos by Bob Jones

I can't think of any mineral that is as geometrically confused as calcite ($CaCO_3$), the most stable polymorph of calcium carbonate. It develops such crazy shapes—as if it can't decide which crystal system it belongs to—but is still beautiful in every form it adopts. It can also camouflage itself in a variety of colors.

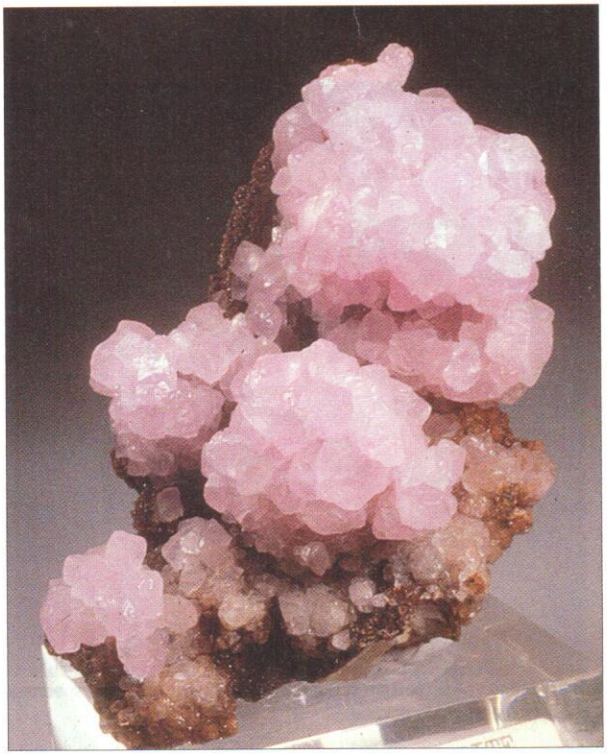
**This lovely pink calcite crystal formed atop a cluster of prismatic quartz crystals.**

Calcite forms more than 300 crystal shapes—far more than any other mineral! In a cave environment or mine cavity, it can really go nuts, shooting off in every direction and forming weirdly shaped clusters. Crystals may grow in circular or corkscrew forms, at right angles, or in groups of pencil-thin strands.

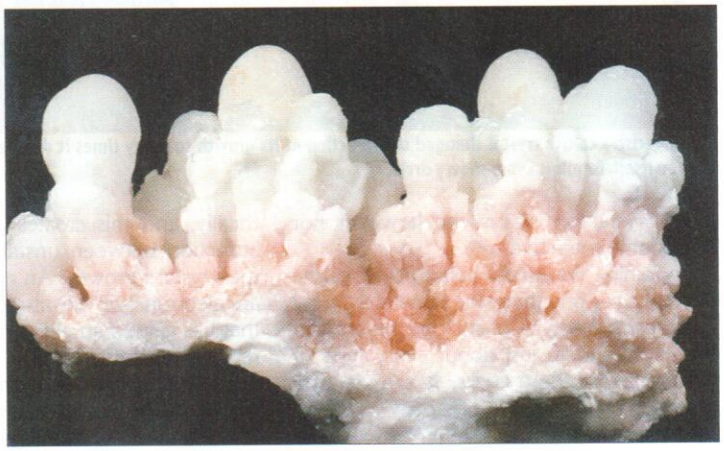
Given a chance it takes on colored disguises, either by enclosing another mineral, like copper, or picking up random ions of other minerals; for example, cadmium ions turn the calcite yellow, while cobalt gives it a lovely pink-violet hue.

In a cave environment, water dripping from above deposits calcium carbonate as long, tapering stalactites on the ceiling or builds up on the floor as stalagmites. When these two types of formations meet, they form a calcite column. Layered deposits of calcite form solid masses with wavy patterns that give them the look of a waterfall. Exposed calcite waterfall formations can be seen in the Mammoth Springs area of Yellowstone National Park. Another unusual form of calcite is rounded crystallizations that resemble pearls and eggs!

Proof that calcite has a "split" personality can be seen when you place a transparent rhombic cleavage of the mineral on a printed page. As light passes through the calcite, the mineral's structure splits it into two beams and a double image of the print is seen. This effect is known as "double refraction".



PRIVATE COLLECTION



*ABOVE:* **Normally colorless, calcite can take on vibrant hues by accepting random ions of another mineral, in this case, cobalt.**

*TOP RIGHT:* **This is the most famous bird's nest calcite specimen. Found in a Bisbee, Arizona, copper mine, it has been featured in publications.**

*BOTTOM LEFT:* **Knobby calcite is not unusual when it forms in a cave setting. This specimen is from Bisbee, Arizona.**

When a hot, calcite-rich solution cools slowly, the mineral can't decide which shape to take. Initially, it forms the flat, hexagonal poker chips. As the solution cools a bit more, the crystals take on a slanted box form. Farther down the temperature scale, they go hexagonal, then dog-toothed, and finally form simple, six-sided crystals at the coolest extreme. I can think of no other mineral—even quartz—that adapts to changes in its environment this way, as if it had no personality of its own. If it were human, we'd put it on a couch and analyze it!

You could spend your whole life collecting this versatile mineral and never discover its every secret! No matter what form or color it takes or the circumstances of its formation, it is beautiful, and that's why it is such a popular mineral.

When limestone, a massive form of calcium carbonate composed of the polymorphs calcite and aragonite, is subjected to high heat and pressure, it metamorphoses into marble. Marble is simply beautiful no matter what its color. A snow-white variety was carved by a host of artisans into stunning works of art, like Leonardo da Vinci's "David". Marble quarried from Mount Pentelikos, which has a light-yellow tint, was used to construct the Acropolis of Athens during the fifth century.

When marble is impure, the included minerals can form colorful veins in a host of patterns. These features make it one of the most gorgeous materials for construction and architecture. Just visit the Carnegie Museum of Natural History in Pittsburgh or the Sistine Chapel in Rome to see what I mean!

Luckily, calcite is also a very common mineral found in ore veins, sedimentary deposits and metamorphic occurrences. This means every collector, young and old, regardless of financial status, can assemble a wonderful collection of this calcium carbonate.

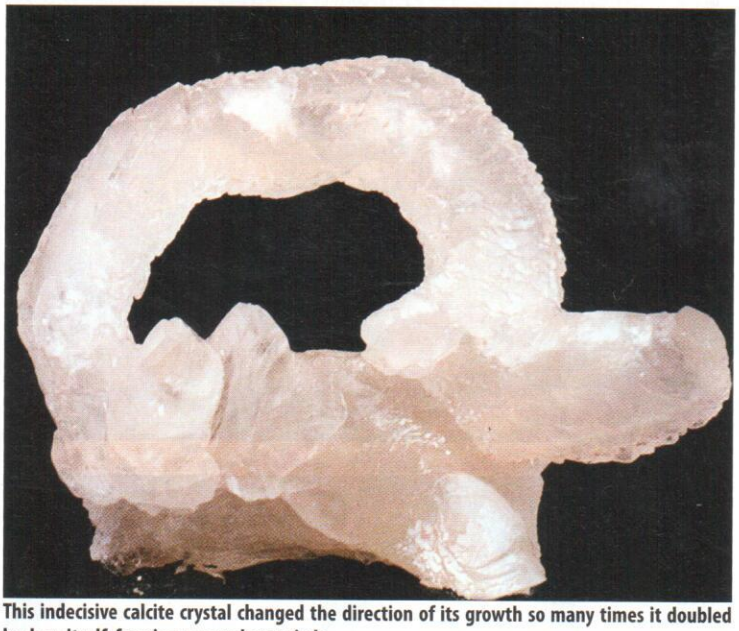
Calcite has a simple chemical formula. It usually forms crystals at relatively low temperatures, but can also crystallize from hydrothermal solutions. The earth has vast strata of limestone, the impure rock form of calcite. Water can dissolve limestone to varying degrees, depending on its acidity; it readily combines with carbon dioxide to form carbonic acid and picks up organic acids from the soil. These corrosive solutions eat away at limestone, carving out caverns and creating all the underground formations we enjoy.

When groundwater comes to rest in a cavity, vug, or open vein, the calcite in the water starts crystallizing. This accounts for the nice calcite crystals that are so common in the vugs, cavities, and open seams in limestone. These are almost always dog-tooth crystals, which form best at relatively cool temperatures.

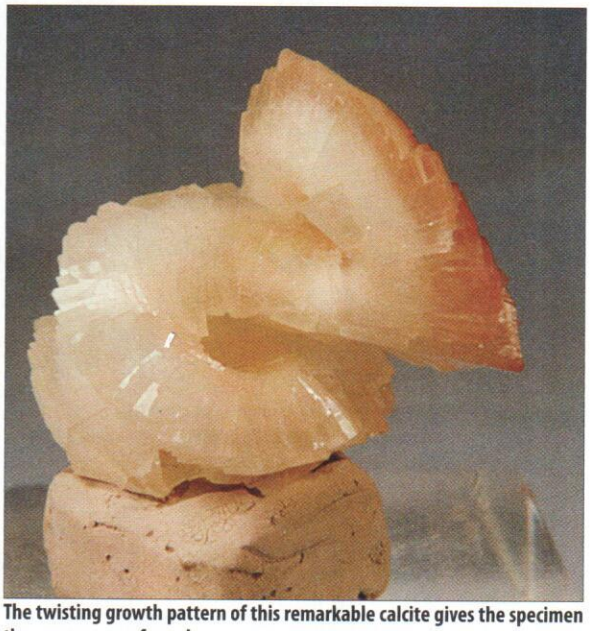
In ore deposits, hot solutions surge up from the earth's interior carrying all sorts of dissolved minerals, including calcite. As the calcite encounters conditions that are suitable for its crystallization, it forms the wonderful poker chip crystals, which are flat and hexagonal and usually show nice, sloping modifications along the edges.

Perhaps the best-known source of these lovely poker chip crystals is the San Sebastian mine at Charcas (San Luis Potosi), Mexico, where such disks have been found that measure several feet across, in clusters that look like a spilled stack of poker chips. This mine has produced countless specimens, so any collector can obtain a nice one by searching diligently at shows. The silver mines at Guanajuato, Mexico, have also produced these odd poker chip calcites, but not in the quantities obtained from Charcas.

Calcite has a cousin—actually, a polymorph—called aragonite that can act almost as oddly. Calcite and aragonite have the same chemical formula, but develop in different crystal systems. Calcite's form is trigonal hexagonal, while aragonite's is orthorhombic. Snow-white aragonite that forms twisted, stalactitic, curling or branching shapes has been dubbed *flos ferri* ("flower of iron"). Though aragonite normally develops orthorhombic crystals, it can disguise itself very nicely as a hexagonal mineral when it forms sixling twins. It cannot take on as



This indecisive calcite crystal changed the direction of its growth so many times it doubled back on itself, forming a very showy circle.



The twisting growth pattern of this remarkable calcite gives the specimen the appearance of a corkscrew.

many crystal forms as calcite, however, nor is it double refractive.

Explaining these odd behaviors of calcite isn't easy. For one thing, the mineral is found in almost every type of rock in the crust of the earth, and in just about every type of occurrence in those rocks. It can develop from solutions that are extremely hot, very cold, and every temperature in between. So as calcite reaches a point of nucleation and crystal growth starts, it is subject to every possible factor that influences the growth of crystals, which is why it is found in so many shapes and circumstances.

There is no question that the environment in which the calcite crystallizes plays a major role in the result. "Environment" refers to a number of things. The temperature of the calcite solution is critical. At times, atmospheric pressure is a factor because, if the rock surrounding a closed vug or pocket is hot, it can cause a buildup of pressure within the pocket.

As a calcite-rich solution drips from the ceiling of an open space, such as a cave, there is often a movement of air. This breeze can influence the direction of growth by exerting subtle pressure on one side of the formation, or it can cause the calcite-rich water to evaporate more quickly on one side than it does on the other.

Equally important is electrical attraction. Keep in mind that atoms and molecules are made up of protons with a positive charge and negatively charged electrons. If they are in balance, there's no problem. But if electrons are lost or added, the atoms and molecules can be out of balance electrically, and this creates a subtle force of attraction between unstable atoms during the crystal's growth. An atom that has lost an electron will be attracted to an atom that has gained an electron. Their goal is to reach electrical neutrality.

Though calcite is found almost everywhere, some sources have gained classic status because of the unusual or odd forms found therein. Fontainbleau, near Paris, produced calcite crystals packed so full of gray sand they were called "sand calcites". These rough-surfaced crystals were in perfect form and looked as though they had been cast of sand, when in fact the sand was being held together by calcite.

Calcite from the classic source in the Egremont, England, area is beautiful when it twins and uses iron oxide for color.

Perfectly transparent crystals of calcite are widely known as "Iceland spar". They are so named because huge, water-clear crystals of calcite were found in several places on the island country of Iceland. One such location was the Helgustadanama mine at Reydarfjord.

Some water-clear crystals were several feet across. When broken along their perfect cleavage planes, they yielded huge numbers of rhombohedrons, which were used to demonstrate the mineral's property of double refraction. This means the calcite has the ability to split the light that enters the rhomb into two rays. Two disks of this material—one rotating over the other—can be used to identify some minerals. The finest grade of calcite has been used in refractive microscopes. True Iceland spar is a classic collector mineral.

A classic type of Arizona calcite is commonly called "bird's nest" calcite. In a cave stetting, calcite-rich water drips to the floor and develops a shallow, saucerlike calcite growth. When a grain of sand or a bit of organic material gets into that depression, the dripping calcite begins to envelope the grain. Gradually, a rounded calcite "egg" develops. A depression that holds several eggs greatly resembles a bird's nest. The technical name for these eggs is "oolite", a term that is also applied to rounded calcite nodules that are found in other settings. If the nodules are perfectly round—or nearly so—they can be called "pisolites" or "cave pearls".

For the fluorescent mineral collector, calcite from the mercury mines around Terlingua, Texas, might be considered a classic type of calcite. Under the long-wave ultraviolet lamp, it will glow pink, and under

**China has come out with remarkable twinned calcites that are doing their best to rival the classic twinned calcites from the famous mines in Egremont and Frizington (Cumbria), England.**

short-wave UV it is blue. Even more exciting, when you turn off the long-wave lamp, the pink response fades to blue phosphorescence, which can linger for some time. Similar material has been found in Mexico in recent years.

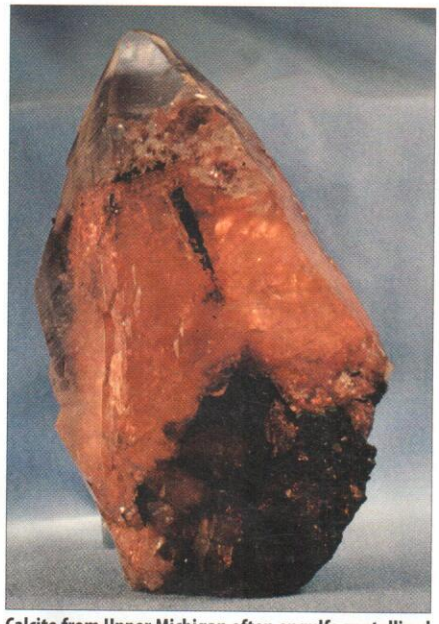
Of all the forms of calcite, those crystal specimens that show twinning are the most highly prized and eagerly sought by collectors. One of the least known, but certainly classic, Mexican sources for twinned calcite is in a famous tourist area called the Cobre Del Barranca ("Copper Canyon") in Chihuahua. The most important mine is the Porvenier, but there are others located in Urique and Areponapuchic canyons (Bocoyna, Chihuahua).

The most noteworthy of these calcite twins are known locally as "corazon" ("heart-shaped"), though many of them resemble the pointed shape of a spearhead because of the deep reentrant angle at the top of the flat crystals. These are always seen as loose crystals, never on matrix.

William Panczner, in his book *Minerals of Mexico* (Van Nostrand Reinhold, 1987), reported that the largest of these twinned crystals weighed over 25 pounds! Unfortunately, although I accompanied Panczner on some of his sojourns into Mexico while he was writing the book, I was not able to make it to the Copper Canyon area to see these amazing crystals!

The Mexican twins are eclipsed in popularity and classic status by the far better-known twinned calcites from Egremont and Frizington (Cumbria), England. This remarkable area produced truly classic calcite

**This calcite from the Faraday mine, near Bancroft (Hastings County, Ontario), Canada, took on a metallic disguise.**



**Calcite from Upper Michigan often engulfs crystallized copper to form a marvelous specimen.**

twins that most collectors thought would never be duplicated. How wrong we were! China has come out with remarkable twinned calcites, many of them lightly tinted pink to brown with iron oxides. Another recent source of fine calcites, many of them twinned, is the borate deposit at Dalnegorsk (Oblast Wray), Russia.

All the classic calcites—among them, the classic copper-in-calcite specimens from Michigan's Upper Peninsula—have become prohibitively expensive. The Copper Country mines have long since shut down, so examples of this wonderful mineral combination in tapering dog-tooth crystals are beyond the reach of the average collector's pocketbook.

The old silver mines of Germany were once a great source of calcite crystals, some of which showed really odd forms. These mines, too, ceased operations long ago, so you'd be really lucky to add one of these classics to your collection. The same can be said for the amazing, huge calcites that were coming out of Rossie, New York, in the 1800s!

Once in a while, you can still find a lovely green calcite from Tsumeb, Namibia. These crystals are unusual because they have formed in a very regular, stepped arrangement with rounded edges. During the growth process, they managed to enclose dioptase, which produced the nice green color. With Tsumeb now closed, these will soon be classics.

The beauty of this remarkable carbonate mineral is that every time a popular mine closes, a new source opens, and this very common, but eminently collectible, mineral shows up in one or more beautiful crystal forms. It's an ideal mineral species to collect, study and enjoy.