

Why Pyrite Crystals Have Different Shapes.

Some minerals come in a variety of crystal forms. For example, pyrite commonly forms cubes, octahedrons, pyritohedrons or some combinations of these forms. All pyrite is FeS_2 with the same internal arrangement of iron and sulfur atoms. Why then, should pyrite crystals take on different shapes? All these forms reflect the same internal atomic symmetry, so the reasons must involve the conditions under which the pyrite forms. These are such things as temperature, pressure, acidity, and the composition of the fluids from which the pyrite grew.

Knowing what controls the different forms may be of practical value. Geologists studying pyrite in copper mines in Peru, Japan and Utah noticed that the richer parts of ore veins contain pyrite as pyritohedrons while the poorer zones contain pyrite as octahedrons and the barren zones contain pyrite as cubes.

The conditions forming the different sorts of pyrite crystals have been studied recently by Murowchick and Barnes at Penn State University. They grew pyrite crystals under controlled conditions in the laboratory. They found pyrite could form rods, smooth cubes, striated (grooved) cubes, octahedrons, pyritohedrons or dendrites under varying temperatures and degrees of supersaturation. These factors control the speed at which the crystals grew. For example, the rod shaped pyrite crystals form when growth rates are the slow due to a combination of low temperatures and low amounts of dissolved iron and sulfur. These crystals are very similar to the needle-like pyrite crystals found in geodes at Halls Gap, Kentucky.

If the temperatures are a bit higher or the supersaturation greater, smooth cubes of pyrite form. As the degree of supersaturation increases, the cubes become more and more striated. Eventually, at higher temperatures or degrees of supersaturation, octahedrons form, then pyritohedrons. These are the common forms of pyrite found in many places through the world. Now, we see that their distribution and occurrence is not random, but gives important information on the chemical conditions of the area at the time when the pyrite grew.

At the highest degrees of supersaturation, crystal growth is very fast and odd dendritic clumps of pyrite form looking like the branching frost crystals that form on windows. Natural pyrite crystals showing this habit are very rare, but have been reported around hot springs on the deep sea floor. In these settings pyrite growth is very rapid as the hot water comes out of the crust and chills instantly against sea water.

At the mines studied, it appears that the richest parts of the veins were where the pyrite was forming, the fastest, likely closest to the source of the fluids. It is thus possible to map an ancient hydrothermal system just by using pyrite crystal forms. This could lead to cheap and easy ways to find new deposits and understand old ones.

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References:

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