

Minerals of the Wrong Feather Don't Flock Together

Most rockhounds know that minerals are identified by their physical and chemical properties. Many also know that an important clue in mineral identification is association - certain minerals are often found together. For example, malachite often is found with copper and gold is often found embedded in quartz. What many don't realize is that another important identification clue is that many minerals are NOT found together. For example, lazurite, sodalite, and corundum are never found associated with quartz. As another example, beryl does not occur with dolomite in our local limestones. Well, why not? Doesn't that seem a bit arbitrary? Isn't "never" sort of a strong term to be used by a scientist. It turns out that there are good chemical reasons why this is so.

In some cases, it is simply a matter of a particular rock type not having the needed chemicals to make the minerals. There is no chemical incompatibility between dolomite and beryl, yet we don't find beryl in limestone. Why not? In order to make beryl, you need to have beryllium, a chemical present in, at best, trace amounts in most limestones. By analogy, you can't make a chocolate cake with no chocolate - not matter how hard you try. The fact that chemicals tend to segregate in certain places in our earth leads to the commonly observed mineral associations. Certain granites have lots of beryllium in them - it's an element that tends to accumulate in such magmas. Thus beryl is found in granites, along with the typical quartz, feldspar, mica and tourmaline.

In other cases the mineral won't form because the proper temperature, pressure or other geochemical conditions (such as acidity) were not achieved in the rock. For example, diamond won't form in a rock unless certain conditions are met.

In yet other cases there is a true chemical incompatibility. It is because of this that quartz is never found with olivine, corundum, sodalite or lazurite. These minerals are just not chemically stable together. Does this mean if you put a piece of corundum next to a piece of quartz that they'll explode? Of course not. The point is that the two minerals will simply not form together in the same environment. If corundum forms, quartz won't form and vice versa. The reason is that corundum forms only in a low silica environment, but quartz only in a high silica one.

Let's consider a hot magma. There are no minerals in the magma - only loose atoms darting around. As the magma cools, these atoms begin to bond together to form minerals. Let's suppose this is a low silica magma. There are lots of other chemicals, such as aluminum around. The aluminum likes to

link to what silica there is around to form feldspars. But since this is a low silica magma, there isn't enough to go around. The extra aluminum has to go somewhere, so, when it gets concentrated enough, it forms corundum. Now let's suppose this is a high silica magma. All the aluminum finds silica and makes feldspar. Now there is silica left over, so quartz eventually forms. In the first case, you have a rock formed consisting of feldspar and corundum, in the second case you have a rock formed consisting of feldspar and quartz. You can never get a rock with quartz and corundum forming together in it. There are similar relationships between quartz and sodalite, olivine and several other minerals.

So if someone offers you a specimen of corundum crystals embedded in quartz, start looking for the glue!

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