

Silicon, Silica, Silicates and Silicone

People get confused about the differences between silicon, silicate, silica and even silicone. What is it exactly that we collect, cut and polish??

Silicon is a chemical element, one of the 97 natural building blocks from which our minerals are formed. A chemical element is a substance that can't be subdivided into simple substances without splitting atoms. Silicon is the second most abundant element in the earth's crust, making up about 27% of the average rock. Silicon links up with oxygen (which makes up 55% of the earth's crust) to form the most common suite of minerals, called the silicates. Quartz, feldspars, olivine, micas, thomsonite, jadeite, and prehnite are all silicates. There is so much oxygen around that pure native silicon is almost never found naturally.

Silica is a bit trickier concept. It refers the combination of silicon plus oxygen. The mineral quartz is silica. But so are the minerals tridymite, coesite, cristobalite and stishovite which are mineral forms of silica that are stable at high temperatures and pressures. All these minerals are also silicates. In other words, quartz is a silicate made of pure silica. But feldspars contain sodium, aluminum, potassium and calcium in addition to silicon and oxygen. Thus feldspars are silicates but they aren't pure silica.

Geochemists also use the term "silica" to refer to the overall silicon and oxygen content of rocks. This is confusing, but stems from the fact that in rock analysis and sample is dissolved, the solution treated, and the amount of silicon present is determined by precipitating it as silica. So a geologist may say "This rock is 48% silica". A rockhound will look at the rock and say "How can that be? I don't see any quartz in it!" Both are right. The rock will not have the mineral quartz because the silicon and oxygen are tied up with other elements to make silicate minerals like feldspar. Its a bit like looking at a cake and saying "I don't see any eggs in there!" The eggs are cake ingredients but are present now in different forms.

Now, what is silicone? Its a synthetic polymer of silicon with carbon and oxygen that could be in solid, liquid or gel form. It has all kinds of medical uses, such as in antacids, artificial joints, pacemakers and implants of various notoriety, but is not, as far as anyone knows, found in rocks.

Can pure silicon be found in Nature? Yes, rarely. Recently Russian geologists were sampling gasses from Kudriavy volcano on the Kamchatka Peninsula. Here they drove quartz tubes into vents jetting out gases of over 900 degrees C. Their tubes filled with minerals precipitating from this gas. Among them were pure silicon metal embedded in masses of salts such as

halite. The silicon formed crystals up to 0.3 mm across. It was associated with pure aluminum metal, Si-Al alloys and other rare minerals. This find was unusual enough to warrant a note in the prestigious science journal, Nature.

So unless you are in Russia sampling hot volcanic gases, you can be sure that what you are finding are silica and silicates, but not silicon or silicone.

- Dr. Bill Cordua, University of Wisconsin-River Falls

Reference:

Korzhinsky, M.A., et al., 1995, "Native Al and Si Formation", Nature, vol. 375, p. 544.