

JOHN'S CORNER:

MINERALS - The Elements and What They Do (Part 7)

by John Ferguson

14) Silicon (Si) - Silicon is the second most abundant element in the earth's crust (28% by mass) and most abundant element in soils 43-63%. Silica is found in igneous rocks at 281,500 ppm, in shale at 73,000 ppm, sandstone at 368,000 ppm, limestone at 24,000 ppm, in fresh water at 6.5 ppm, and seawater at 3 ppm. Silicone is found in marine plants at 1,500-20,000 ppm, some marine animals at 70,000 ppm, and land animals 120-6,000 ppm. In our soils, we find silicon at 330,000 ppm in the form of silicon oxide (SiO₂) in silicate minerals from sand to clay.

Silicon, chemically speaking is a very stable element with a primary oxidation state of +4. The element carbon has an oxidation state of -4. When we combine silicon (Si) with carbon (C) we get silicon carbide (SiC) that we call carborundum and it is one of the hardest minerals known (second only to diamond) and used in many industrial applications. Silicon is also similar to carbon in its ability to form complex molecular chains.

When we combine silicone with oxygen in a crystal form, we get the very common mineral called silicone dioxide (SiO₂) which we know as quartz. However, if we combine silicone and oxygen in a non-crystalline form it then occurs as the gemstone, which we know as Opal and is believed to be of biological origins.

Silicon is used in timing devices like quartz watches, it is a major ingredient in common glass and when silicon is combined with oxygen, it is used in many lubricants. Silicon is required in producing the semiconducting crystals used in many types of electronics (computers, radios, television) to solar cells. If we combine silicone polymers with boric acid, we get the children's toy called "silly putty". Note: Silicon is not silicone, which is a rubber or plastic like polymer. In rare cases (mining operations), too much silicon dust can result in silicosis caused by breathing very fine particles of silicon dust.



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Silicon is the third most abundant trace element in the human body and present in all bodily tissues. The highest levels are in bone, connective tissues, skin, hair, arteries, and nails. Silicon supplementation can increase collagen in growing bones by 100%.

Silicon promotes the absorption and metabolism of calcium and significantly reduces the absorption of aluminum. In areas of the world that have higher silicon levels in their food they also have the lowest prevalence of hip fractures. Ovarian cancer is linked to a broken gene, silicon has been found to protect and keep this gene functioning properly. Silicon gel applied to badly burned skin rapidly increases healing.

Silicon deficiencies are linked to brittle hair, brittle finger and toenails, poor skin quality, poor calcium utilization, and arterial disease. It is believed that silicon is an essential trace element in a number of areas of human physiology and metabolism, especially bone and connective tissue.

The best sources of silicon for humans is from plants such as cereal grains as they have higher silicon contents or beer made from barley malt which is also a good source of bioavailable silicon.

Gardening and Landscaping Problems Associated with Silicon (Si)

Silicon is a component of all earthy materials; rock, sand, silt, or clay (e.g. soil). Silicon is more available in alkaline soils. A common component of plants that is absorbed from the soil or growth media as dissolved silicon in the form of (H₄SiO₄) silicic acid. Silicon definitely influences plant growth but all the effects due to silicon are not fully understood.

We now know that silicon is necessary for the growth and development of plants. It helps plants resistance to withstand exposure to toxic chemicals. It increases a plants resistance to diseases especially those caused by pathogenic fungi and it strengthens plants cells and walls which reduces water lost in tissues. Silicon is found in grasses 0.3-1.2%, in leguminous species at .05-0.2%. Some plants have silicon content of over 10% such as sedges, nettles, horsetails, sponges and diatoms. N eedles made of silicon cause nettle stings.



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Rice plants accumulate up to 10% silica in their hulls and 4% in the grains and it strengthens the rice stalk. Note: The high levels of silicon in rice hulls make it slow to decompose hence the hulls are often used as a planting media as it does not shrink as quickly as other type media. Researchers at the University of Florida have found that silicon boosts the disease resistance of rice crops to fungal diseases. However, a lack of phytoavailable silica will cause rice crops to fail.

A lack of silicon in most plants will cause young leaves and fruit to look lumpy or otherwise deformed since silicon is required in the cells skeleton (structural element).

Sources: diatomaceous earth, algae and bacteria, sand, clay, granite or basalt sand and other mineral silicates, chicken skin has high levels of silicon.