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JOHN'S CORNER:

MINERALS - The Elements and What They Do (Part 16)

by John Ferguson

24) Chromium (Cr) - The name comes from the Greek word "chroma" which means color, as the various salts of chromium are brightly colored. Chromium is a hard slippery metal with a blue sheen and a member of Group 6 on the periodic table.

Chromium is found in igneous rocks at 100 ppm, shale's at 90 ppm, sandstone at 35 ppm, and limestone at 11 ppm. However, in soils derived from basalt or serpentine, levels of 3,000 ppm have been recorded. Most forms of chromium are not soluble, so seawater has only 0.3 ppm chromium and fresh water even less under normal conditions (not polluted).

Chromium will dissolve in some acids but not phosphoric acid. It is used to make stainless steel, and in chrome plating. Chromium oxide (Cr_2O_3) is used as a green pigment in glass, paints, and glazes. It is also used in tanning leather (Tanneries are a major source of chromium pollution today). Potassium chromate is a dye while chromium (Cr-VI), and copper arsenate, (CCA) was used as a wood preservative till outlawed due to its toxicity. It is also added to make chrome vanadium steel, which is used to make high quality tools do to its hardness, strength and rust resistance. Small amounts of chromium in emeralds give them the green color and in ruby's the red color. Chromium oxide (CrO_2) is magnetic and was used in magnetic tapes and discs for many years.

Chromium commonly occurs in nature in two common oxidation states, chromium (III) as in (Cr^{+3}) which is safe. However, the other form chromium (VI) (Cr^{+6}), as chromate (CrO_4^{-2}) is very toxic and carcinogenic. The dangers of chromates have been known for over a 100 years. The 2002 film "Erin Brockovich" brought attention to the illegal dumping of chromate waste. Sewage treatment plants are a major source of toxic chromium pollution.



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Chromium is essential to human health, while it is very rare, but too much can be toxic. It is estimated that 25-50% of US citizens are deficient in chromium because of low soil levels while other newer studies suggest over 90% of the population is deficient.

Artificial fertilizers only contain 16 elements at best and do not contain chromium, vanadium, and other trace minerals. This has led to major deficiencies of trace elements in our food supply. As a result, hundreds of health problems are caused or aggravated by nutritional deficiencies.

Humans do not store chromium as we excrete chromium in our urine. High sugar drinks from sodas to some juices increase the natural loss of chromium by 300% for over 12 hours.

Animals that lack chromium have an impaired ability to use glucose, suffer mild diabetes, and have reduced cholesterol levels.

We know that mild deficiencies of chromium can produce symptoms such as anxiety and fatigue and people with chromium deficiencies have shorter life spans. Diseases associated with a chromium deficiency are aggravated by a vanadium (V) deficiency.

People with higher levels of chromium have a much lower incidence of diabetes and atherosclerosis than those with low levels. Some studies have found that chromium supplementation increases muscle gain and fat loss. It has been found that sufficient amounts of chromium can prevent and cure adult onset diabetes as chromium picolinate regulates insulin. The first studies linking low blood sugar and diabetes to chromium were in 1957. The organ in humans with the highest amount of chromium in the body is the placenta. We know that human levels of chromium decrease with age hence supplementation is important as we get older.

Chromium is involved with hormones that affect protein, carbohydrate, and fat metabolism. It is also involved with the body's metabolism of glucose (sugar), brain function, insulin performance, thyroid function, and in hormonal balance.



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Foods high in chromium are oysters, calf's liver, egg yolks, peanuts, black pepper, brewer's yeast, molasses, and wheat germ.

Cravings for sweets and chocolate are indicators of chromium (Cr) and vanadium (V) deficiency, as some chocolates have 1,800 ppm of chromium!

Gardening and Landscaping Problems Associated with Chromium (Cr)

The role of chromium in soils, microbes, and plants is not fully understood. We have learned that 150 ppm of chromium is toxic to some plants and that chromium tends to accumulate in the roots. However, sufficient amounts of chromium stimulate plant growth.

In healthy soils, soluble chromate gradually turns into insoluble chromium (III) salts and then becomes unavailable for plants to absorb. In soils with lots of organic matter, chromium VI is reduced to chromium III the non-toxic form.

Chromium is found in the bodies of microorganisms that live in the soil. Most soils average 60 ppm of chromium. However, the application of artificial fertilizers containing phosphorous can lead to toxic amounts of chromium in the soil of over 700 ppm.

More chromium is absorbed and held in clay soils than sandy soils. In mafic soils derived from alkaline igneous rocks, chromium levels can be much higher.

Bacteria in the soil can absorb chromium into their bodies reducing the available amount in soils and bacteria have been used in remediating some toxic areas.

Plants cells have the ability to convert chromium VI to chromium III that then reacts with DNA and proteins. Some grasses and clovers can accumulate chromium up to 4,000 ppm. Aquatic plants tend to accumulate more chromium than land plants.

More and more people are growing their own vegetables and fruits so they can have healthy food full of beneficial trace minerals to eat. Sources: basalt sand, serpentine