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JOHN'S CORNER:

MINERALS - The Elements and What They Do (Part 19)

by John Ferguson

27) Cobalt (Co): The name comes from the German word "kobald" which means goblin. Miners mined an ore called "smalite" which is cobalt arsenide (CoAs_2). When they tried to smelt the ore arsenic gas was given off, and they cursed the ore saying it was bewitched by goblins hence the name.

Cobalt is found in the earth's crust at 20 ppm on average and it is the 32nd most abundant element. In soils it averages only 8 ppm, (some soils are now less than 0.1 ppm). It is found in igneous rocks at 25 ppm, shale's at 19 ppm, almost none in sandstones and limestones, almost none in fresh or salt water, in land animals at 0.3 ppm and marine animals at 0.5 ppm. Cobalt occurs in higher concentrations in mafic rocks like basalt where it can reach 200 ppm as compared to acidic rocks like granite. Soils derived from serpentine rocks or basalt rock can be much higher. Many soils around the world are absolutely devoid of cobalt. The geochemical cycling of cobalt in soils is similar to iron and manganese.

Cobalt is a lustrous silvery blue metal, which has the property of being ferro- magnetic and it is a member of group 9 on the periodic table. When cobalt is added to steel, it creates strong magnetic properties, which were used in WW-II to make mines to destroy shipping. Cobalt is used in alloys to make magnets, in ceramics, in catalysts, and in paints. It is found in stainless steel used to make razor blades and in body parts such as found in knee replacement, drill bits and milling machines where extreme hardness is required.

Cobalt was used for coloring glass to get a deep blue color as far back as 1361 BC. It is used as a starch for laundry purposes as it makes clothes appear whiter and it once was used to make invisible ink. Cobalt chloride was used to decorate flowers in the 1800's as people would



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dye white flowers pink and they would stay this color if the weather was moist and humid. As the flowers dried, however they would turn violet and then blue.

Cobalt is essential to all forms of life from algae, bacteria, fungi, insects, birds, reptiles, etc. It functions as a cofactor and activator for enzymes, and involved with fixing nitrogen during amino acid production.

Liming of soils and the use of artificial fertilizers is a major factor in preventing cobalt absorption (phytoavailability) by plants. This practice leads to a deficiency in plants and then creates a dangerous deficiency in ruminants. A few mammals like cows and sheep make enough B-12 for their needs if they graze on grass grown on soil with the element cobalt. As the microbes in their gut ferment and digest plant material, they also convert elemental cobalt into vitamin B-12 that the animals can absorb. Humans cannot make B-12 and it needs to come from our food. The vitamin B-12 has a ring structure similar to hemoglobin and chlorophyll.

Cobalt is a constituent of vitamin B-12 molecule, where it is one of the rare carbon to metal bond in nature and directly bonded to a methyl group. Vitamin B-12 is one of the most important vitamins in our bodies as it regulates our immune system. A lack of this vitamin causes pernicious anaemia, where the body cannot produce enough red blood cells. Over 30% of B-12 originally in our food is destroyed by cooking.

If humans have a low salt content (NaCl), we cannot absorb B-12. This is why people on low salt diets have to have B-12 shots. Due to low cobalt in our soils and low salt diets, vegetarians frequently have B-12 deficiencies. Calcium (Ca) is also required for cobalt to cross from the intestine into the blood stream.

Cobalt is used in myelin formation as it helps convert cholesterol into myelin which protects our nerves; babies nursed by a mother deficient in B-12 can develop permanent nerve damage.

Cobalt has been found to be a necessary cofactor for the production of thyroid hormone. In mammals, it is essential for hemoglobin formation and for prevention of nerve degeneration.



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Cobalt is found in the bodies of microorganisms that live in the soil and bacteria in the soil make B-12, which is then absorbed by plants. In a marine environment blue - green algae and other nitrogen-fixing organisms require cobalt.

Food sources: sweet corn, lettuce, and cabbage are high in B-12, while fruits tend to be low, clams, sardines, salmon herring, liver, and eggs, nuts, chocolate or other sources of this element.

Foods exposed to light are quickly depleted of this vitamin, canning destroys this vitamin, while vitamin - C helps protect vitamin B-12.

The RDA for B-12 is only 3-4 mcg, however new research is showing that people whom consume 250-400 mcg are much healthier, as unused B-12 is flushed out by our kidneys. As one doctor stated "I rather have expensive urine than cancer".

In our soils, cobalt can exist in its +2, +3 and +4 electrical (oxidation) states but mainly occurs in its +2 state. As in most other +2 elements glyphosate (Round-Up) would prevent the microbes from absorbing cobalt and making B-12. Another reason to avoid purchasing GMO's foods and buy organic wherever possible.

Most of the soils that our agriculture is done on, are depleted in cobalt. Over the years, microbes used cobalt to make B-12 and the plants (crops) absorbed it. Since cobalt is not one of the 16 elements that our agricultural universities deem important, farmers never replaced it. Now many of our agricultural soils are depleted of cobalt. Coupled with nutrient tie-up from artificial fertilizers, much of our food no longer supplies the essential vitamin B-12.

Gardening and Landscaping Problems Associated with Cobalt (Co)

For years, we thought that plants do not require cobalt. Now there is evidence that cobalt is used in chlorophyll formation and in mitochondrial respiration at the cellular level.



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Plants can absorb cobalt through their leaves and cobalt is needed in legumes for nodule formation and nitrogen conversion and fixation. Seeds started without cobalt will not grow into a viable plant.

Cobalt is used in protein synthesis by plants, and it is required for nitrogen fixation by bacteria in the soil. Cobalt is also required by blue-green algae to fix nitrogen from the air.

Cobalt deficiency inhibits the growth of most plants especially legumes. In legumes cobalt deficient plants develop more lateral nodules but fewer crown nodules. Excess cobalt will be transported to plant leaves where it will cause white leaf margins and tips. However, some plant species like *Nyssa sylvatica* (Black Tupelo) grown in cobalt-contaminated soil may accumulate up to 800 ppm without *problems*. Some plants can accumulate cobalt such as legumes, borage, myrtle, and violets and levels of 2,500 ppm have been measured.

Sources: compost, seaweed, fish emulsion, basalt sand.