

JOHN'S CORNER:

MINERALS - The Elements and What They Do (Part 37)

by John Ferguson

70) Ytterbium (Yb)

A soft silvery white metal that is slowly oxidized by air and reacts slowly with water. It is a member of the rare earth elements but twice as common as tin.

Found in igneous rocks at 3 ppm, shale at 1.9 ppm, sandstone at 1.3 ppm, and very little in land plants or animals.

Used as a doping agent in lasers where it creates color centers that store energy and found in many memory devices. The compound ytterbium bromide is used in the lighting industry. It has no known biological role, however ytterbium salts stimulate metabolism.

In rodent studies, 14% of ingested ytterbium by the mother is transferred to the newborn mice. It is not readily absorbed by plant roots, hence very little gets into the food supply.

Gardening and Landscaping Problems Associated with Ytterbium (Yb)

Vegetables can have 0.08 ppb of ytterbium but some lichens can absorb 900 ppb.

Sources: mineral sands of igneous rocks, some coals have 170 ppm

71) Lutetium (Lu)

Originally called Lutecium but changed to Lutetium by international agreement. Lutetium is the last of the lanthanide series of rare earths and is the densest and hardest of this group. It is another of the



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rare earth series that is found in igneous rocks at 0.5 ppm, shale at 0.33 ppm, and very little in sandstone or limestone. There is very little lutetium found in marine or land animals.

Lutetium is a silvery white metal that is the most costly element in the world even though it is more common than silver. It often occurs in the ore monazite and it is used as a catalyst in cracking, alkylation, and polymerization in many industrial processes.

No known biological role, however ytterbium salts stimulate metabolism. The highest amounts are in our bones with some in our livers and kidneys.

Gardening and Landscaping Problems Associated with Lutetium (Lu)

None

Members of the *Carya* species can accumulate up to 4.5 ppm

Sources: mineral sands of igneous rocks

72) Hafnium (Hf)

Hafnium is a lustrous silvery metal that is ductile and resists corrosion. Powdered hafnium will burn in air and resistant to most acids.

Hafnium is found in igneous rocks at 3 ppm, shale at 2.8 ppm, sandstones at 3.4 ppm and only 0.3 ppm in limestone. Soils average around 3 ppm of hafnium while almost none is found in seawater.

It is used in electric plasma torches to cut steel and can be anodized into attractive colors.

No known biological role

Gardening and Landscaping Problems Associated with Hafnium (Hf)



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Hafnium has no known biological role in plants even though plants have 0.01-0.4 ppm of hafnium depending on the soil they were grown. Some marine plants will accumulate 10 ppm in their tissues.

Sources: mineral sands of igneous rocks, sewage sludge at 3 ppm

73) Tantalum (Ta)

Tantalum is a silvery shiny soft metal that is found in igneous rocks at 2 ppm, shale at 0.8 ppm, sandstone and limestone at 0.05 ppm, and extremely little in seawater at 0.0000025 ppm. However, marine animals accumulate up to 410 ppm.

Virtually every modern electronic device from cell phones to TVs to computers used tantalum capacitors in its circuits. Tantalum is almost impervious to chemical attack and resist corrosion hence it is used in surgery implants from plates for skull fractures to bolts to fasten broken bones.

Tantalum carbide is harder than diamonds. It has a very high melting point of 6,760 °F (3,738 °C) where it is used in special cutting tools.

Tantalum has no known biological role and appears to be non-toxic.

Gardening and Landscaping Problems Associated with Tantalum (Ta)

None

Found in plants at less than 5 ppb.

Sources: mineral sands of igneous rocks

74) Tungsten (W)

Tungsten is found in igneous rocks at 1.5 ppm, shale at 1.8 ppm, sandstone at 1.6 ppm and limestone at 0.6 ppm and soils at 1 ppm. Seawater has very little tungsten in it at 0.0001 ppm, but marine plants



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have 0.35 ppm. There is very little tungsten in land animals (0.005 ppm) where it is found in the heart muscle and our teeth.

Tungsten is a lustrous silvery-white metal and is the strongest metal at very high temperatures and it is very inexpensive. However, it has the same density as gold hence commonly used to make gold plated ingots (fake gold).

Tungsten carbide is used in cutting tools and in items that need to stay sharp, it is much harder than steel and does not fracture like diamonds. Due to its hardness, it is used in armor piercing bullets and to replace lead in shotgun shells.

Other uses include, used like lead in radiation shielding, used in special welding electrodes and used in incandescent light bulbs.

In humans, tungsten is found in our bones and in our spleen. A lack of platinum in the diet increases the rate of mortality in goats.

Gardening and Landscaping Problems Associated with Tungsten (W)

Required by some bacteria to live and grow. They contain an enzyme, which incorporates tungsten that can reduce carboxylic acid molecule to an aldehyde.

Tungsten has similar chemical properties as molybdenum (Mo) and has been found to substitute for molybdenum (Mo) in several microbial enzymes.

Plants can absorb tungsten from the soil and some trees can have 100 ppm. The species *Pinus sibiricus* is a accumulator plant.

Watering with sodium tungstate (Na_2WO_4) solution increases the growth and yield of grapes and alfalfa. Barley has been found to absorb tungsten when it was applied to a soil.

Sources: mineral sands of igneous rocks, fly ash from burning coal, sewage sludge

75) Rhenium (Re)

Found in igneous rocks at 0.005 ppm, marine plants at 0.014 ppm, and land plants 0.014 ppm. Land animals have very little rhenium where it is found in the thyroid tissue.

Rhenium is a silvery metal with a high melting point and similar chemical properties to manganese (Mn). The electrical or oxidation states range from -1 to +7. Rhenium diboride (ReB₂) is so hard it will scratch diamonds. It is used in nickel-iron super alloys to make turbine blades in fighter jets.

No known biological role and appears to be non-toxic.

Gardening and Landscaping Problems Associated with Rhenium (Re)

None

Sources: mineral sands of igneous rocks

76) Osmium (Os)

Found in igneous rocks at 0.0015 ppm. It is oxidized by organic matter to osmium oxide (OsO₄) where it is later reduced to osmium (Os).

Osmium is a silvery metal with a bluish tint that slowly oxidizes and is the densest of any element. Osmium is the hardest metal and is used in fountain pen tips and phonograph needle tips. Some compounds of osmium have shown anti-cancer effects.

It has no known biological role and appears to be non-toxic in pure form. However, some compounds are highly toxic.

Gardening and Landscaping Problems Associated with Osmium (Os)

None

Sources: mineral sands of igneous rocks

77) Iridium (Ir)

Found in igneous rocks at 0.001 ppm, land animals at 0.00002 ppm and land plants at 0.62 ppm.

Iridium is the second densest element but only by a little bit (one tenth of one percent). It is the most corrosion resistant metal known. High-grade automobile spark plugs with iridium tips will last far longer than conventional plugs.

Iridium is relatively rare in the earth's crust as compared to other elements but is common in asteroids and comets. Iridium found at archeological or geological sites is used to help date them.

No known biological role and appears to be non-toxic.

Gardening and Landscaping Problems Associated with Iridium (Ir)

None

Sources: mineral sands of igneous rocks

78) Platinum (Pt)

Platinum is a dense malleable transition metal and is considered a noble metal due to its resistance to corrosion.

Platinum is the premium element in society and more costly than gold since demand is so high, even though it is the 75th most abundant element. Rocks collected on the moon tend to be higher in platinum than those on earth. Platinum is found in igneous rocks at 0.005 ppm and land animals at 0.002 ppm.



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Platinum is able to withstand powerful acids and high temperatures and is very stain and corrosion resistant. It is used as a catalyst in many chemical reactions such as refining crude oil into gasoline to our usage in catalytic converters in our cars.

It is used to make medical implants and its compounds are used as anti-cancer drugs.

Platinum is found in the muscles of mammals at a low level of 0.2 ppb even though it has no known biological role and is considered non-toxic in its pure metallic form. Some salts of platinum are highly toxic.

Gardening and Landscaping Problems Associated with Platinum (Pt)

Plants growing on soil derived from platinum bearing rocks can absorb up to 6 ppm where most of it is in the roots. Depending on the platinum chemical compound, proteins can bind some of the forms that are highly toxic.

Plants growing near roadways have higher levels of platinum. Radishes have been found that have 530 ppm, and some tobacco plants can accumulate 23,300 ppm.

Sources: mineral sands of igneous rocks, some coals have 230 ppm, sewage sludge where the platinum comes from ingested drugs.