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Selenium and other trace elements in phosphate rock of Sechura (North Perú

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Selenium is an essential trace element to human and other animal health, but it has a narrow range between a dietary deficient and a toxic excess. Both extreme situations provoke diseases to livestock and humans. Therefore the biological status of Selenium in regards to human health is one of the most remarkable examples of the paracelsian paradigm.

Selenium deficiencies in crops and selenosis have been reported in a number of regions of the world.

A common approach to remediating the deficiency in soils consists in applying selenium rich fertilizers in order to increase the amount of this essential element taken up by plants, animals and humans. Sodium selenite and selenate are frequently used. A more cost friendly approach could be the application of rock phosphate fertilizers, that are usually rich in selenium and other trace elements. However, the presence of phosphate in soils has been recognised to have a dual activity : As well as phosphates (rich in selenium) providing selenium and other essential nutrients in soils lacking in this element, they can also inhibit the uptake of selenium in plants by phosphate-selenite antagonism (using phosphates with low levels of Se to remediate selenosis). Furthermore some other trace elements found frequently in the rock phosphate elements such as As, Cu, and Cd, have all been shown to decrease the toxicity of selenium and they

have been used to alleviate Se poisoning in livestock.

It is therefore understood that whether using rock phosphate for remediating Se deficiencies or excesses of toxicity in soils and fodder crops, it is necessary to control the trace element composition of the phosphate rocks. Phosphate ores of different geographical sites are very varied, and even ores from the same outcrop or quarry can vary substantially in trace element levels.

The aim of this work is to determine the concentration of Selenium, As, Cd, Cr, Cu, Ni, Pb, Sb, Tl, V and Mo of the phosphate rock from the Sechura desert, coastal region of Grau, Northern Peru (Lat. 06 º 05'South and Long 80º 50'West).

Trace element contents ("pseudototal" fraction) were extracted with "aqua regia" and "easily available" with EDTA 0.02M, pH 4.65. The determination was made by ICP-AES (Polyscan 61 Spectrometer) Cr, Ni, V and Zn and by ICP-MS (Elan 6000) Se, Pb, Cu, Cd, Tl, V, As and Mo.

The distribution of the concentrations of Se and the relationship with the concentrations of As, Cd, Cr, Cu, Ni, Pb, Sb, Tl, V, Zn and Mo were investigated. The *pseudototal* 95 % confidence interval for the mean were: Se 2.4 $\pm$ 1.2; As 14.3 $\pm$ 6.8; Cd 17.3 $\pm$ 10.9; Cr 133.6 $\pm$ 46.6; Cu 17.0 $\pm$ 4.4; Ni 16.9 $\pm$ 4.9; Pb 5.6 $\pm$ 1.6; Sb 0.63 $\pm$ 0.21; Tl 0.44 $\pm$ 0.23; V 49.2 $\pm$ 9.7; Zn 65.4 $\pm$ 21.8; Mo 30.4 $\pm$ 19.2, and the *bioavailable* 95 % confidence interval for the mean were: Se 0.75 $\pm$ 0.3; As 1.9 $\pm$ 1.3; Cd 8.1 $\pm$ 4.5; Cr 0.095 $\pm$ 0.068; Cu 2.6 $\pm$ 0.6; Ni 1.3 $\pm$ 0.4; Pb 1.3 $\pm$ 0.4; Sb 0.011 $\pm$ 0.002; Tl 0.071 $\pm$ 0.026; V 1.8 $\pm$ 0.8; Zn 9.6 $\pm$ 7.4; Mo 0.99 $\pm$ 0.52.

The significant Pearson's correlation coefficients (log transformation was performed to achieve normality) in the *pseudototal* analysis were: Se-Ar 0.65 (p=0.021), Se-Cr 0.72 (p=0.008); Se-Sb 0.64 (p=0.024); Se-Tl -0.63 (p=0.029); Se-Mo 0.82 (p=0.001) and the significant Pearson's correlation coefficients in the *bioavailable* analysis were: Se-Pb 0.59 (p=0.043); Se-Mo 0.73 (p=0.007), log transformation was used too.

For comparative reasons, several phosphate rocks of different geographical regions were also analysed.