

## Heavy metals and trace element distribution in Eppawala Apatite deposit

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### Introduction

In Sri Lanka, the dominant source of drinking water used to supply major urban and rural communities is from wells, tanks, rivers, springs. Although there are no systematic and comprehensive water quality assessment programs in the country, there are increasing indications of water contamination problems in some parts of the country. Causes for water contamination are natural or anthropogenic. Among natural contamination, water-rock interaction is critical but remains hidden for most eyes. No sufficient study has been conducted on heavy metal contamination of drinking water of the Eppawala apatite area in Sri Lanka. The main objective of this paper is to determine the influence of some of the physicochemical parameters and heavy metals and trace elements in drinking water and its distribution of different parts of the Eppawala.

### Methodology

The groundwater was studied around the Eppawala Apatite Deposit (EPD) using tube well and dug wells as the access. Sample size (60) was determined by distribution of the population around the EPD. Samples were collected in wet season and dry season. The electrical conductivity was measured in situ with Orion 3 Star EC meter. The collected water samples were analyzed for seventeen (17) parameters including major cations, anions, heavy metals and trace elements. Cations, heavy metals and trace elements concentration with the Varian SpectrAA AAS facility available at the Uva Wellassa University. Anions including  $\text{SO}_4^{2-}$ ,  $\text{Cl}^-$  and  $\text{HCO}_3^-$  were measured using standard methods. The major cations such as Ca, Cu, Fe, K, Mg, Mn, Na, Zn, Cs, Sr, Li, Rb, and major anions such as  $\text{SO}_4^{2-}$ ,  $\text{Cl}^-$ , F<sup>-</sup> and  $\text{HCO}_3^-$  were analyzed using the ORIGIN 8 and Surfer software.

### Results and discussion

In terms of electrical conductivity, it ranged from 19.2ms/cm-1.02ms/cm in wet season and 1.75ms/cm-0.32ms/cm in dry season. Normally Na<sup>+</sup>, Mg<sup>+2</sup>, F<sup>-</sup> and Cl<sup>-</sup> are the highly abounded elements in the selected area well water in wet season. That's value are above the Sri Lankan drinking water stranded.

Table 01: Highly effected elements in the wet season collected samples

Parameter	Mean value (ppm)	Drinking water standard level (ppm)
Chloride (Cl <sup>-</sup> )	3270	1200
Fluoride (F <sup>-</sup> )	1.31	1
MagnesiumMg <sup>2+</sup>	158	150

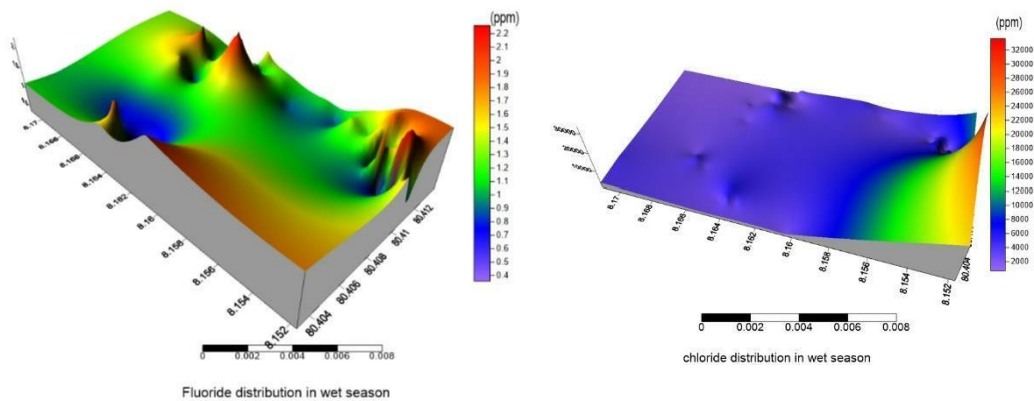


Figure: 1 Fluoride and Chloride distribution in wet season

Furthermore, there is a highly vary Mn<sup>+2</sup> in both wet and dry season( mean value 0.007ppm and 0.1ppm) As well as Li ( mean value 0.003ppm and 0.015ppm). In table 02 and 03 are summarized the all parameters in wet and dry season.

Table 02: Elements analyzed results of wet season

Parameter	Mean value	Standard deviation	Range
pH	7.9	7.5	6.1 – 8.2
Conductivity(mc/cm)	2.87	2.57	19.2 - 1.02
Chloride (Cl <sup>-</sup> )	3270.17 ppm	1969.4	9633.8 – 772.4
Fluoride (F <sup>-</sup> )	1.31 ppm	0.56	2.2 – 0.16
Bicarbonate (HCO <sup>-3</sup> )	205.7 ppm	81.77	439.2 – 48.8
Phosphate (PO <sub>4</sub> <sup>-3</sup> )	0.42 ppm	0.129	1.10 – 0.211
Sulphate (SO <sub>4</sub> <sup>-2</sup> )	1.11 ppm	0.51	3.14 – 0.42
Calcium (Ca <sup>+2</sup> )	145.57 ppm	154.69	1100 – 31.9
Cesium (CS <sup>+1</sup> )	0.68 ppm	0.56	1.74 – -0.37
Copper (Cu <sup>+2</sup> )	0.037 ppm	0.016	0.013
Ferrous (Fe <sup>+2</sup> )	-0.009 ppm	0.018	0.065 - -0.024
Potassium (K <sup>+1</sup> )	2.17 ppm	1.38	8.85 – 0.65
Lithium (Li <sup>+1</sup> )	0.003 ppm	0.004	0.003 - 0
Magnesium (Mg <sup>+2</sup> )	158.58 ppm	89.19	608.79 – 52.75
Sodium (Na <sup>+1</sup> )	383.56 ppm	238.24	1000 – 64.64
Manganous (Mn <sup>+2</sup> )	0.007 ppm	0.019	0.15 - -0.003
Rubidium (Rb <sup>+1</sup> )	0.397 ppm	0.113	0.689 – 0.044
Strontium (Sr <sup>+2</sup> )	1.90 ppm	0.99	5.12 – 0.037
Zinc (Zn <sup>+2</sup> )	0.013 ppm	0.022	0.132 – 0.003

Table 03: Element analyzed results of dry season

Parameter	Mean value	Standard deviation	Range
pH	7.28	0.245	7.85 – 6.85
Conductivity	0.87 ms/cm	0.394	1.75 – 0.32
Lithium (Li <sup>+1</sup> )	0.015 ppm	0.006	0.026 – 0.005
Manganous (Mn <sup>+2</sup> )	0.1 ppm	0.196	0.621 – 0.051
Rubidium (Rb <sup>+1</sup> )	0.232 ppm	0.033	0.271 – 0.168
Strontium (Sr <sup>+2</sup> )	2.831 ppm	1.098	5.298 – 1.002

## Conclusion

According to the results, heavy metals and trace elements concentration are changing seasonally. Most of the heavy metal and trace element in groundwater around EPD are not exceed Sri Lanka drinking water standard level. Chloride (Cl<sup>-</sup>) is the highly abundant elements in the groundwater in the selected area (mean Cl<sup>-</sup> concentration is 3270.17 ppm). According to the Sri Lankan drinking water standard Cl<sup>-</sup> should be below the 1200 ppm. Fluoride (F<sup>-</sup>) is highly present in the water sample (1.31 ppm). According to the Sri Lankan drinking water standard F<sup>-</sup> level should less than 1 ppm. It is the big problem in this sample collected area.

## References

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