

QUALITY OF WATER IN SRI LANKA

by

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Introduction

The quality and quantity of ground water resources are a vital factor with respect to man's utilization of many of the arid areas of the earth. Ground water is the most critical and valuable of all earth resources. Surface waters are more accessible than ground waters, but they represent less than 5% of the fresh water available to man. The remainder is almost all ground water.

Water is called "the universal solvent". All natural substances will dissolve in water to some measurable extent, given the proper circumstances and time. In addition, water is capable of penetrating below the surface of the earth, to depths as great as 2km and dissolving natural materials. Some of this solute containing water will eventually return to the surface and become part of the water system. The quality of water, therefore, depends on the geological formations and their structure through which water has passed. The detection and interpretation of these substances in water form the basis of hydrogeochemical studies (See also Fig. 1).

Sri Lanka has a population of 15 million (1981) of which about 25% is estimated to be urban. The annual population growth rate during 1971-1981 was 1.7%, the estimated urban and rural growth rates being about 2.0% and 1.5%, respectively. It has been estimated that there are

over one million wells spread all over the island of which 40% are used mainly for drinking and cooking purposes, 30% for bathing only and the balance for both. In Sri Lanka, the percentage of safe water remains at 10% - 15% and greater emphasis should be placed in providing safe drinking water to the population.

(a) Quality of Ground water

The ground water of Sri Lanka can be classified chemically and a map showing the distribution of the different water types has been prepared (Figure 2). The ground water has been classified into 4 major types, namely Ca-type, Mg-type, Na/K-type and non dominant cation (NDC) type. The Ca-HCO₃ type is found predominantly in the Wet Zone of the Central Highlands and appears to be associated with the NDC types. In the Dry Zone, the Na/K-type is dominant, whereas in northern areas particularly in the Jaffna Peninsula, the Ca-Cl-type is abundant. It is apparent that the distribution of the different ground water types is markedly affected by underlying geology and climatic factors.

(b) Quality of Surface water

Investigations of the quality of water in the Mahaweli River, the Kelani River, the Mid-canal, Kandy, the Kandy Lake, Kandy and Polgolla reservoir, show defined variations in water quality determined by the degree to which quality of water in surface water are affected by anthropogenic sources.

(c) Quality of Tap water

It is also apparent that careful monitoring of tap water is necessary even though serious health hazards caused by tap water have not been frequently reported in Sri Lanka. The presence of Pb, pH values of less than 6.50 and greater than 9.20 are considered unsuitable for domestic tap water supplies. (Table 1).

(d) Quality of Rainwater

It was observed that except for minor occurrences "acid rain" is still not prevalent in Sri Lanka. It is of interest to note that average pH in the dry zone is 5.47, and 5.15 in the wet zone, showing the absence of excessive acidity. The lowest pH of 3.92 was revealed at Katugastota. In general pH values of less than 5.00 are found in the eastern and western parts of the island.

Implications to Human Health

In general, natural waters rarely contain chemicals in excess concentrations to result in adverse effects on human health. However, there are few notable exceptions to this general rule; NO_3^- , Ca^{2+} , Mg^{2+} and F^- which occur in sufficient frequency to warrant particular attention.

1. Fluoride and Dental Diseases

From the observations on the distribution of fluoride in drinking water and the incidence of dental diseases in the areas concerned, it is apparent that a distinct correlation exists between the diseases and the geology of the delineated areas. The geochemical distribution of fluoride in the rocks and minerals along with the climatic factors are responsible for the prevalence of dental diseases in Sri Lanka.

2. Total hardness and heart diseases

It is interesting to note that the areas underlain by high Ca-bearing rocks have a lower rate of cardiovascular diseases. The Northern Province, however, appears to be a special case in that in spite of high hardness of water, the cardiovascular disease rates are also high. This could well be accounted for by adverse effects of the excessive fluoride found in water. As pointed out by Keul in spite of doubts concerning a casual relationship, it is closely associated with drinking water and has a damaging influence on the health of the population. It is not known whether this factor can be found in the water itself or only correlates with it.

3. Nitrates and Human Cancer

A study of the incidence of various types of human cancer in relation to nitrate concentrations in Sri Lanka revealed a significant positive correlation for stomach, small intestine, oesophagus and liver cancers, as well as total malignant cancer incidence and benign tumours. The northern and western provinces of Sri Lanka showed the highest cancer rate. The abundance of nitrates in the ground water of certain provinces of Sri Lanka has been attributed to the use of nitrogenous fertilizers, human and animal wastes in densely populated regions and nitrates produced as a result of atmospheric electric discharges and precipitation. Even though the correlation of nitrate abundance and cancer rates is significant, nitrate cannot necessarily be considered as being causative in view of the biological intricacies involved in the complicated mechanism of cancer inducement.

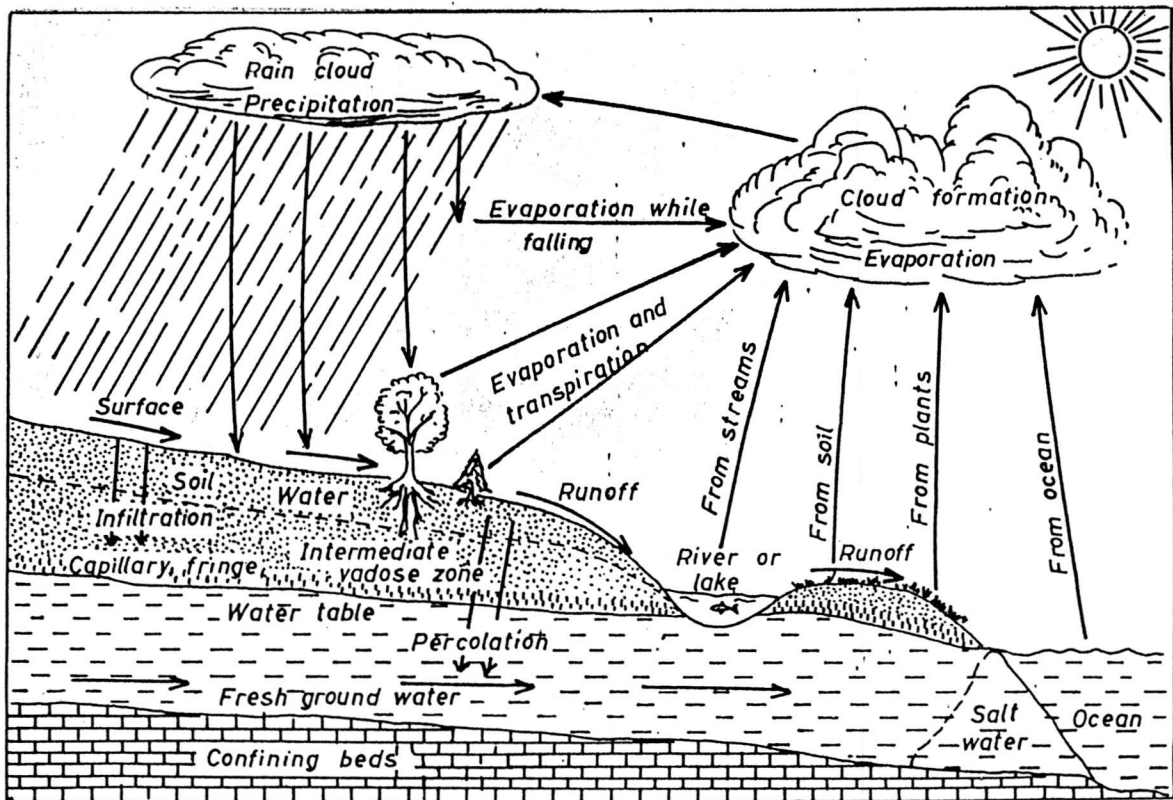


Figure 1 :
 Movements of Ground water
 and Water Table
 (Saskins et.al, 1974)

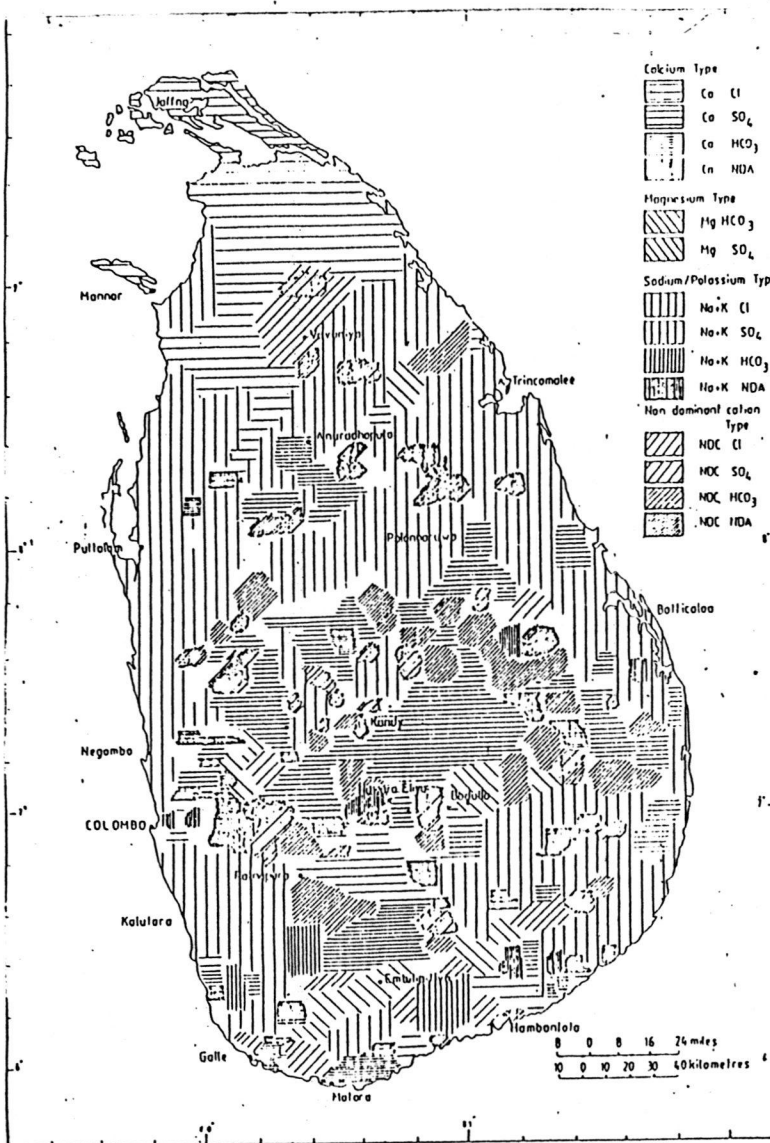


Figure 2 :
 Geochemical Classification
 of Ground water in Sri Lanka.

Table 1 : Distribution of Pb Content and pH levels of Tap water
Pb (ppb)

Group	>30		31-60		61-90		91-20		Total	
	N	Per- cent	N	Per- cent	N	Per- cent	N	Per- cent	N	Per- cent
1	5	62.5	3	37.5	0	0	0	0	8	16.3
2	16	88.9	0	0	0	0	2	11.1	18	36.7
3	12	52.2	3	13.0	8	34.8	0	0	23	4.7
Total	33	67.7	6	12.2	8	16.3	2	4.1	49	100

Group	5 - 5.5		5.6 - 6		6.1 - 6.5		6.6 - 7		< 7.1		Total	
	N	Per- cent	N	Per- cent	N	Per- cent	N	Per- cent	N	Per- cent	N	Per- cent
1	1	12.5	1	12.5	2	25	1	12.5	3	37.5	8	16
2	2	11.1	2	11.1	9	50	5	27.8	0	0	18	36
3	4	17.4	0	0	7	38.8	6	33.3	6	33.3	23	47
Total	17	14.3	3	6.1	18	36.7	12	24.5	9	18.4	49	100