SOME ASPECTS OF HYDROGEOLOGY AND GEOCHEMISTRY OF CRYSTALLINE ROCK TERRAINS IN SRI LANKA WITH SPECIAL EMPHASIS ON MATALE AND POLONNARUWA DISTRICTS

Thesis presented by

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ABSTRACT

Matale and Polonnaruwa districts are located adjacent to each other in the north central part of Sri Lanka covering an area of approximately 5400 square kilo meters.Geologically the whole area forms a part of the Precambrian crystalline rock complex of Sri lanka aconsisting of predominantly Highland group of rocks, namely charnockite and charnockitic gneiss, granulite, biotite gneiss, calc gneiss, quartzite and crystalline limestone (marble).

Climatic as well as geomorphologic features vary significantly over the area when moving from south to north. In the southern and south western parts,wet zone conditions and elevated ridge and valley topography are common climatic and geomorphological features.In the northern and north eastern parts, dry zone conditions and low undulating land surface are characteristic features.

Some aspects of hydrogeology and hydrogeochemistry of the area was assessed under this study, based on field and laboratory investigations.Data of a large number of water supply bore holes located in the area including pumping tests were collected and processed. Chemical and bacteriological analysis of water samples were also carried out.

Hydrogeological studies reveal that the occurrence of groundwater and the productivity of hard rock aquifers in the study area depend on the type of rocks, depth and character of the weathered overburden. Crystalline limestone and quartzite form the best aquifers whereas all other rock types form relatively less favorable aquifer conditions.The productivity of the aquifers decrease with depth.The best yielding zones

in the hard rocks were found at depths less than 50m from the ground level.

The study area is dissected by a large number of tectonic lineaments and some of those are visible on areal photographs and on landsat imageries. The effect of these visible lineaments on the yields of water supply bore holes (and therefore on the productivity of the aquifers) is not well marked in the area possibly due to their inter connection and the presence of a large number of unseen tectonic lineaments that also contribute to the yield of the bore holes.

The groundwater movement follows the directions of surface water movement on the regional scale. The depth to groundwater table is highly irregular in the study area but with a decrease in average depth towards North-East. In the vast majority of the water supply bore holes, the water table is present within the limits of weathered overburden. This situation together with the high intensity of fractures present at shallow depths in the hard rocks suggests that there is a good hydraulic connection between the overburden and underlying hard rocks.

The results of pumping tests indicate that the aquifers are of non-uniform character and with relatively low hydraulic conductivity.

On the regional scale, the productivity of the hard rock aquifers depend on the effect of one or a combination of geology, structure,degree of tectonization and the rain fall in the study area.

Under Hydrogeochemical studies,the occurrence and distribution of pH,

Electrical conductivity, Fluoride,Total hardness and Total Iron contents in groundwater of the study area were investigated in detail.

The area-wise distribution of the chemical parameters shows a striking similarity regarding the general shape of the distribution pattern for Electrical Conductivity and Fluoride in ground water. It seen that the regional distribution of these two parameters is controlled mainly by rainfall, evaporation and general flow direction of surface and ground water. The regional distribution of pH of groundwater does not show any clear correlation with any hydrogeological, climatic or geomorphological conditions in the study area. The area wise distribution pattern of Total Hardness shows a pattern reflecting geological as well as climatic conditions. The distribution of Total Iron content in ground water appears to be controlled by structural and tectonic factors while the influence of geology, hydrogeology, climate and geomorphology appears to be less significant.

The relation of rock type and chemical water quality among the 6 major rock types in the study area shows only slight differences. However, the groundwater in quartzite has shown relatively low concentrations of chemical parameters except for the natural Iron Content.

The micro-biological quality of groundwater in the water supply bore holes is much superior when compared with the ground water from shallow dug wells with regard to the coliform bacteria found in the water. Differences in the technical design of these two types of water supply sources appears to be responsible for this quality difference.