EVALUATION OF IRRAWADDIAN AQUIFER IN YANGON AREA

PhD DISSERTATION

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ABSTRACT

This research is emphasized on the hydrogeological nature of Irrawaddian rocks of the Yangon area. The study area approximately covers about 700 km^2. The present study is based on the data of about 200 tube wells and over 700 chemically analysed data.

The Yangon area is underlain by sandstones and shales of the Pegu Group which is of Miocene age, sandstones and clays of the Pliocene age of Irrawaddy Formation, sands and gravels of the Pleistocene Valley-fill deposits and silt and clays of the Recent Younger Alluvium. The prominent geological structure is NNW-SSE trending Shwedagon- Mingalardon anticlinal ridge and Irrawaddy rocks are mainly distributed on this ridge. In the study area, three major faults are observed.

There are only two major groundwater aquifers serving as the source of the water supply in Yangon area; namely Valley-fill deposits and Irrawaddy Formation. In Arzarnigon sandrocks of Irrawaddy Formation, water quality is good to fair with high total dissolved solids (TDS) and high content of iron at some places such as Thaketa, Thingangyun and Dagonmyothit. Three water bearing horizons of Arzarnigon sandrocks are noted in Thuwunna area. Danyingon clay unit of Irrawaddy Formation gives very low yield because of less permeable clay.

The thickness of Arzarnigon sandrocks is ranging from 100 feet to 300 feet thick. In the study area the groundwater moves from the recharge area towards their main streams of Ngamoeyeik creek in the east and Yangon river in the south. In Dagonmyothit area, groundwater flow is generally towards the west and finally into the Ngamoeyeik creek. Also in Thaketa and Dawbon townships, groundwater flows into the Ngamoeyeik creek and Bago river.

According to the mineralogical study, most of the Irrawaddian aquifer sand samples are mainly composed of sub-angular to sub-rounded shaped quartz (about 80-90 %) and feldspar (maximum 15%). Magnetic fraction is less than 1% and a few contents of hematite, hornblende, chalcedony, rock fragments and trace of ilmenite, goethite, topaz and zircon are also noted.

Resistivity survey shows that promising first and second geoelectrical layers of Pyinmabin area having about 200 ohm-m is found as third geoelectric layer at Dagonmyothit area. Thus, the fact that good water bearing layer of Pyinmabin is inclined towards Dagonmyothit is in accordance with the underlying structure of Irrawaddian rocks.

The results of grain size analysis of the aquifer sand samples from Irrawaddy Formation indicate that dominant particle size is 0.25 to 0.425 mm and is mainly composed of fine to medium-grained sand. Water well screen opening of 0.75 to 0.95 mm is the best for production wells to be placed in Arzarnigon sand unit of Irrawaddy Formation using proper gravel pack materials.

Transmissivity (T) value of the Irrawaddian aquifer is ranging from 50 to 150 m^2/d which was calculated by using the constant discharge Jacob's time drawdown method. Exceptionally, the value of less than 50 $m^2/$ d is found in Bagan road and very high (T) value of 440 $m^2/$ d is found in People's park well. Generally, very low (T) value occur in the wells being constructed at or around anticlinal ridge where as very high (T) is noticed at the western part of anticlinal ridge where Valley-fill deposits overlie the Irrawaddian rocks.

Recovery test is made at 10"diameter production well No 19 of People's Park and 10" diameter production well No 20 of National Theatre, Dagon Township. It shows very high Transmissivity value reaching up to 7784 (m^2/d). Therefore probable source of recharge for western part of anticlinal ridge is assumed to be from the Valley-fill deposits of older alluvium unit.

Rhythmic fluctuation of the hydraulic head occur at the 6 inches production well No 38A, Myayamon Water Front Villa, Dagonmyothit (South) which is about 0.72m difference during six hour. Its fluctuation may be due to the influence of tidal action. The aquifer was hydraulically connected with tidal action. So it is necessary to correct the measured dynamic water levels from hydrograph.

The statistical analysis indicates that magnesium and sulphate is strongly associated in Irrawaddian aquifer of Yangon area. The classification of Piper analysis indicates that the major type of groundwater is Ca-Mg-Na Cl type.

In Yangon area, 56 water samples from tube wells were analysed by using Wagtech Arsenator. Six water samples show the arsenic content with 1 to 4 ppb which is less than the maximum permissible arsenic content of WHO standard for drinking water that is 50 ppb. Generally the level of arsenic in groundwater of Irrawaddian aquifer is safe for drinking.

Bacteriological analyses of water samples from Pyinmabin tube wells show the absence of harmful bacterial constituents during December 2001 to June 2008.

According to the regression analysis of Pyinmabin wells, silica content, potassium and calcium cations uniformly increase. Although silica content becomes increased up to over 30 mg/l, it has still remained under WHO standard of 50 mg/l.

Chloride, nitrate and metallic elements of nickel are gradually increasing. Chloride and nitrate concentration are still in safe condition. The gradual increase of chloride is probably from rechargeable sources i.e. originally chloride rich formation like as Pegu Group rocks. The nitrate concentration may come from livestock and agricultural sources.

The pH values become less than 5 in 2008 due to some major causes of heavy rain water.

Although hardness, calcium, conductivity, pH value and iron content of the Pyinmabin wells are similar to those of Hlawga water, some constituents such as chloride, magnesium and sulphate of Hlawga water are significantly much higher than those of groundwater in the end of the year 2006.

Static water levels and pumping water levels of the Pyinmabin wells were measured three times per month and plotted as hydrographs. For well No 604, both static water level and pumping water levels are rising up. More over, specific discharge is gradually increasing at the Pyinmabin wells. Therefore it is promising for the utilization of groundwater resources.