ABSTRACT

A geological and geophysical study was carried out to investigate groundwater accumulations in the hard rock terrain in Monaragala, Sri Lanka. It is important to identify the subsurface structures in the area for studying groundwater bearing formations. In the past, methods such as aerial photo interpretation, topographical maps and geological maps were widely used for identification of regional geological structures. Information from geological methods alone does not provide reliable clues to groundwater accumulations. These methods appear to be suitable for detection of subsurface structures only. Therefore, it is important to carry out different geophysical survey methods to confirm these results.

Two areas of Timbiriya and Kumbukkan Oya at the Monaragala district were selected for the purpose of conducting this research. Geological map and aerial photo interpretation show the subsurface structures in two areas. The well-defined lineaments run along the Mandappan Oya and its tributaries in Timbiriya area could be clearly identified. Small-scale linear structures could be identified in Malgastalawa and Nakkala areas. In Kubukkan Oya, there were few linear structures along the branches of Kumbukkan Oya. In addition to those linear structures, many fracture zones could also be identified at Pinnagolla, Rattanapitiya, Kurundugoda and Hulandawa areas.

During this study, several geological and geophysical methods were applied in the similar area to acquire data on probable groundwater accumulations. Three geological methods such as (a) topographic map (b) geological map and (c) aerial photo interpretation and four geophysical methods including (d) magnetic, (e) very low frequency electromagnetic (VLF), (f) resistivity imager system and (g) self-potential were carried out during the research. The information on subsurface structural significance was obtained using geological and magnetic methods while resistivity and self-potential methods were used for confirmation of groundwater accumulations.

A magnetic survey was carried out to cover the whole study area. Results from this survey indicate prominent magnetic anomalies in both areas. Seven well-defined magnetic anomalies could be observed in area 1 (Thimbiriya) and five in area 2 (Kubbukkan Oya). The strong anomalies show that they run along well-defined linear structures, which were also identified by geological methods. This study also clearly indicates that the drainage pattern of the area is strongly controlled by the geological structures.

Similarly, a Very Low Frequency (VLF) survey was conducted parallel to the magnetic traverses. The very low frequency electromagnetic waves were very weak to detect in the study area. Probably, the instrument used would not have been sensitive in this area. It could have been due to the shadow areas for the VLF signals. The VLF data which were acquired in the study area consist of noises. The analysis and interpretations of VLF data did not provide reliable interpretations to follow up the geological structures and groundwater reservoirs.

Resistivity imager and self-potential surveys were conducted simultaneously in both areas. Site selection was done with the assistance of magnetic survey, which was conducted in the previous year in Monaragala area. These locations were identified as geologically weak zones by magnetic and geological methods.

Possible subsurface structures could be identified by resistivity method as well as the self-potential methods. But magnetic data interpretations do not always agree with the resistivity and self-potential interpretations.

A magnetic survey is important for the detection of dominant subsurface structures. However, magnetic surveys alone may not be enough to verify the existence of groundwater accumulations because magnetic survey always respond to magnetic bodies, magnetic differentiation and accumulation of magnetic minerals. Therefore, it is suggested that in addition to magnetic survey either or both resistivity and self-potential