Exploration and management of groundwater resources in Telangana state, India

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Abstract:

Approximately two third of the surface area of Indian territory is occupied by different types of hard rock which include basalt, granite, gneisses, charnockite, quartzite, khondalite, etc. Hard rocks rendered permeable to allow movement and storage of groundwater in limited quantity in secondary porosity in the form of fractures, faults, joints etc. Most part of the Telangan state is occupied by granites and granitic gneisses of Archaen age below a composite layer soil and weathered formation of varying thicknesses. Top soil cover consists of clayey loam, red loam and sandy loam. Granites and gneisses units may or may not be fractured/ faulted. Thus a two tier set up of aquifer system comprised of weathered rock at shallower depths and fractured/faulted units of granite and gneisses at deeper level prevails over most part of the Telangana state. Precipitation is the main source of groundwater recharging. The weathered zone is the main source of groundwater availability in dug wells which were traditionally used for water supply. But because of withdrawal of groundwater to meet the ever increasing demand of water supply for irrigation, domestic and industrial uses in excess to its recharging, the weathered zones remain almost dry except during rainy season. Thus, the only possibility of groundwater availability lies in geological structures (fractures, faults, joints) within hard rock formations at deeper levels. If geological formations/ structures are saturated with groundwater, a noticeable contrast between the water saturated geological formation/structures and water devoid geological formations/structures would be observed. The former will be characterized with appreciably lower resistivity than that of the later one. Because of this fact, resistivity method is found to be most suitable method among all geophysical methods (gravity, magnetic, seismic etc) in delineation of groundwater bearing zones in hard rock terrains. Groundwater potential zones in hard rock terrains are of finite areal extent and are sporadically distributed. Therefore, delineation of their exact locations poses a challenging task. This paper discusses the efficacy of 2-D electrical resistivity tomography (ERT) in delineation of groundwater potential zones in complex hydrogeological environs of granitic terrains with the help of case studies from some sites located in and around Hyderabad city. ERT results have also been used to identify suitable sites for managing replenishment of groundwater reservoirs for safe and secured water supply. This study has helped in establishing some general criterion about the selection of potential groundwater resources in similar geological environs. This work may serve as a role model for delineation, sustainable development and management of groundwater resources in hard rock terrains.