

Groundwater quality in Eastern Karnataka, India – an end-use analysis

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Physico-chemical characteristics of groundwater in parts of Eastern Karnataka are examined to determine whether they conform to the quality standards of water used for drinking, agriculture and industrial end uses. Eighty eight samples from forty five villages have been analysed for this purpose. Cation abundances in the groundwater are in the order: $\text{Na}^+ > \text{Ca}^{++} > \text{Mg}^{++} > \text{K}^+$. Anion abundances are in the order $\text{HCO}_3^- > \text{Cl}^- > \text{SO}_4^{2-} > \text{NO}_3^- > \text{F}^-$. Only in one locality, SO_4^{2-} content is very high. According to Piper's classification, 42% of the water samples belong to Ca–Mg–Cl type; 30% to the Ca–Mg– HCO_3 , 16% to Ca–Na– HCO_3 , 9% to NaCl and 3% to NaHCO_3 types. Gibbs plot shows that water–rock interaction is the dominant process controlling the major ion chemistry, although there is evidence of evaporation at some places. Out of 45 villages, excess of fluoride, nitrate and uranium are found in 23, 28 and 26 villages respectively. Phosphate is higher than 1 mg/l in all the villages. Lithium exceeds the permissible limit in 27 out of 43 localities. Concentrations of other trace elements Ag, Al, Ba, Tl, As, B, Co, Cr, Cu, Fe, Li, Mn, Ni, Pb, Se, V, Zn and U were determined in selected samples. Arsenic exceeds the permissible limit for drinking water in one village. Groundwater in 21 out of 45 villages is suitable for agriculture, while groundwater of 31 villages is useful for some industries.

Keywords: Agriculture, drinking, end-use, geochemistry, groundwater, industry.

of 1250 mm, eastern districts receive 700 mm. Districts of Eastern Karnataka heavily depend on groundwater, both for drinking and agriculture. Several industries in this part also use groundwater, although surface water is utilised for the purpose wherever it is available. Studies carried out by the Central Groundwater Board (CGWB), State Government Groundwater Department and the Karnataka State Disaster Management Agency, show that groundwater has been overexploited, especially in the southern districts of Eastern Karnataka. Here the water table is showing a fall in the level and the water resources have reached critical stage of exploitation^{1,2} (Figure 1). Availability of water from surface water resources of Tungabhadra and Krishna rivers has prevented overexploitation of groundwater in the northern districts of Eastern Karnataka. In this pilot study, quality characteristics of groundwater in parts of Eastern Karnataka have been examined from the point of view of its usefulness for drinking, agriculture and industrial end uses.

Study area

Eastern Karnataka is a terrain of Archean crystalline rocks (Figure 2). It constitutes the region known as the Eastern Dharwar Craton (EDC)³. Metamorphosed mafic and felsic volcanic rocks and associated metasedimentary rock formations (quartzites, greywackes and limestone/dolomite) of the Archean greenstone belts (the Dharwar Schist belts) and the Peninsular Gneiss (principally a granodiorite gneiss) are intruded by 2.5–2.6 Ga Closepet Granite of monzonite composition in the EDC. In the northern part of the State, these Archean rock formations are