Hydrogeochemistry of the Purana formations of eastern Madhya Pradesh in India

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ABSTRACT

The Raipur and Indravati series comprising the Purana formations of Chhattisgarh consist of conglomerates, orthoquartzites, sub-arkoses, shales, limestones and dolomites. The lithofacies in these have considerable lateral variations. Both Mahanadi and Indravati basins are saucer-shaped with centripetal dips; the arenaceous rocks along the fringes have dips up to 15°, while the younger rocks in the centre are almost horizontal. In carbonate rocks, karst is developed on a regional scale with sinkholes of higher topographic areas linked with resurgences of low relief areas.

Groundwater in the above formations occurs generally under water table condition, but in karstic limestone also under confined condition.

The chemical relationship of groundwater circulating in the various lithofacies are plotted in the trilinear diagrams after Piper. Groundwater within depths of 92 m has carbonate hardness (Secondary alkalinity) exceeding 50 per cent with the chemical properties dominated by alkaline earths and weak acids. The cations and anions in water from similar lithofacies of Mahanadi and Indravati basins are distributed in the same field of the trilinear diagram with almost similar scatter of ions suggesting thereby a similar geochemical environment.

The quality of groundwater is within permissible limits for irrigation and domestic purposes, while softening of water from temporary bicarbonate hardness may be necessary for certain specific industries.

Expansion of groundwater recharge by increasing the ‘area of spreading’ of flood water of the Mahanadi basin and application of the technique in the Indravati basin will enrich the soils. Prevention of disposal of industrial wastes underground, especially in karstic regions will be a primary step in pollution control.

INTRODUCTION

The Raipur and Indravati formations of the Purana system occur in the Chhattisgarh region between the N lat. 18° 45’ and 22° 30’ and the E. long
During the period 1968–71, systematic hydrogeological studies were undertaken in parts of Raipur and Bastar Districts covering parts of toposheet Nos. 64-G, H and K and 65-E and I, to explore the possibility of groundwater followed by the study of chemical quality for growing needs of agriculture and industries. The areas of the present study are all within 300 km of Raipur, the principal township of the region, and are well connected by the road and rail.

**Physiography**

The area covering parts of Raipur, Bilaspur, Durg and Raigarh Districts, is in general a flat country surrounded by arcuate ridges. The average altitude of the hills is about 340 m, while that of the flat terrain is 290 m above M.S.L. The basin has a gentle easterly slope with a local gradient towards the Mahanadi. The river Mahanadi has initially a northerly course, but beyond the borders of Raipur District it has an easterly course. The gradient is gentle, being about a metre per kilometre.

The terrain covered by the rocks of the Indravati series is similar with a maximum altitude of 862 m in the hilly region, while the average elevation of the central flat country is 610 m above M.S.L. Major part of the area is drained by the Indravati and its tributaries and only a small part in the south by the Sabari, both being the tributaries of the Godavari. The Indravati has a gentle westerly course up to Chitrakut (19° 13’; 81° 42’; 65-E/12), where it descends with a fall of about 30 m and thereafter it continues to have slightly steeper westerly course. The Sabari has a southerly course in the area. One of the tributaries of the Sabari, the Mungabar nadi descends with a fall of about 45 m at Tirathgarh (18° 54’; 81° 50’; 65-F/13).

**Climate**

The Chhattisgarh region has a tropical climate with an average minimum temperature of 25°C, while the maximum recorded is 47.5°C. Major part of the area receives an average annual rainfall of about 125 cm. The Bastar District has relatively a milder climate with an average annual rainfall of about 150 cm.

**Geology**

The generalised geological succession in the area is given in table 1.

The strata in general have centripetal dips. The arenaceous rocks along the fringes of the basins have dips up to 15°, while the younger