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Factors Controlling the Aquatic Geochemistry of Upper Catchment of Damodar River Basin

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The water bodies are continuously subjected to a dynamic state of change with respect to lithological characteristics and geo-climatic condition. This dynamic balance in the aquatic system is upset by human activities, resulting in pollution. Mining is one of the major activities causing water pollution. Damodar River Basin is known for its coal deposition and commonly refereed as 'the storehouse of Indian coal'. The upper catchments of the Damodar River basin are actively associated with mining activities for more than a century. More than 500 coalmines including famous Jharia coalfield, which produce prime coking coal, are located in the basin area. Besides, active open cast and underground mine, there are number of abundant coal mines and associated dormant overburden dumps. The presence of active and abundant coal mines, overburden dumps, thermal power plants, coal washeries, coking coal plants and other coal based industries including refractories, steel, fertilizer and cement plants poses serious threats to the quality of available water resource of the area. In the present study, detail investigation of water chemistry of surface, subsurface and mine water of the upper catchment of Daomodar River basin has been carried out to know the source of the dissolved components of waters, geochemical factors controlling the water composition and the suitability of water for domestic, agricultural and industrial uses.

The analytical results show that Ca, Mg, and HCO3 dominate the chemical composition of the water chemistry. However, in the mine water and water samples collected from mining areas having high concentration of sulphate and it replace the dominance of bicarbonate in the anionic abundance. Water chemistry of the study area strongly reflects the dominance of continental weathering aided by anthropogenic activities. Higher concentration of SO_4, Cl and TDS in some samples indicates mining and anthropogenic impact on water quality. The high contribution of (Ca+Mg) to the total cations, relatively high (Na+K)/TZ+ ratio and low equivalent ratio of (Ca+Mg)/(Na+K) suggests combined influence of carbonate and silicate weathering. The higher value of C-ratio for most of the surface and subsurface water signify that carbonic acid weathering is the major proton producer in these waters. However, the low C-ratio for the mine water (average 0.22) and the waters collected near the coal mining areas suggests that either sulphide oxidation and/or coupled reactions (involving both carbonic acid weathering and sulphide oxidation) control the solute acquisition processes in the mining areas. The quality assessment of surface and subsurface water shows that water is suitable for domestic use with few exceptions. The calculated values of SAR, RSC and sodium percentage (%Na) indicate that water can be used in irrigation purposed without any hazard.