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Hydrogeochemical Study of Karst Formation and Drinking Water Quality in Kanger Valley and Adjoining Region, Bastar, Chhattisgarh, India

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Abstract
Karst topography is a unique topography created mainly by the dissolution of soluble materials including limestone dolomite, and gypsum, The hydrochemical processes that aid in the development and evolution of karst systems are examined in this study. Key physicochemical parameters, such as pH, electrical conductivity, total dissolved solids, and main ion concentrations (Ca^{2} , Mg^{2} , HCO , and SO^{2}), were determined by analyzing groundwater and surface water samples. The findings show that karst features including sinkholes, caverns, and subterranean drainage systems are primarily shaped by carbonate dissolution, which is driven by carbonic acid produced from atmospheric and soil CO2. The predominance of calcium-bicarbonate type water, which is indicative of active karstification, is revealed by hydrochemical facies study. All analyzed water samples fall within permissible limits for drinking purposes, indicating their suitability for human consumption. (Gupta, 2024).

Keyword: *Karstification, Hydrochemistry, Ground Water Quality, Water Portability, piper diagram*

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I. Introduction

The source and transportation path of ground water determine its chemical composition. Groundwater comes from a variety of sources, including meteoric, hydrothermal, magmatic, metamorphic, and more. (Raghunath, 1987). Because water is a very potent and effective chemical agent linked to the weathering and disintegration of rocks, the composition of the rock formations that water flows through also has a big impact. Karst landscape formation is greatly influenced by the chemistry of water. Karst landscapes are formed from soluble rocks that dissolve in acidic water, such as gypsum, limestone, and dolomite. A few key elements of water's chemical behavior that aid in karst formation are Acidity, Dissolution, Chemical erosion, Speleogenesis, Karst denudation. For drinking water, geochemical examinations are equally important. (Dar et al. 2014). Following a thorough geochemical survey and characterization, future ground water resource development requires a well-defined strategy through appropriate planning. (Chen et al. 2024)

II. Study Area

Study area Kanger valley national park and adjoining area is located in the south part of the Jagdalpur city, Bastar district, Chhattisgarh occupying a total area of approximate 600 km^2. (Map -1). The region is hilly and extremely diversified, with elevations ranging from 338 to 781 meters above mean sea level. It is made up of plateaus, steep hills, deep valleys, and mostly karst formations. (Gupta et al 2021). The picturesque Tirathgarh Falls and several stream courses cut through the landscape, with the Kanger River acting as the main drainage system. The geological composition consists primarily of Indravati group rocks, featuring sandstone, limestone, shales, and dolostone and covers the toposheet no. 65F/13 and 65J/1. (Ramakrishnan,1987)

III. Methodology

Samples have been collected from several locations near the caves in order to examine the chemistry of the ground water in the area. The container was a 1-litre distilled water plastic container which was emptied and thoroughly washed from the sample water before taking the sample. The proper GPS locations of the sample sites were taken and these samples were immediately shifted to the laboratory facility. These samples were properly preserved and sent to the advanced laboratory for the required analysis. The analytical result acquired from this process has been subjected to critical examination, and an appropriate interpretation has been made. The following parameters were examined in detail during chemical analysis of water samples: pH, Electrical Conductivity (EC), TDS, Total Hardness, Bi-carbonate, Chloride, Calcium, Magnesium, Sodium, and