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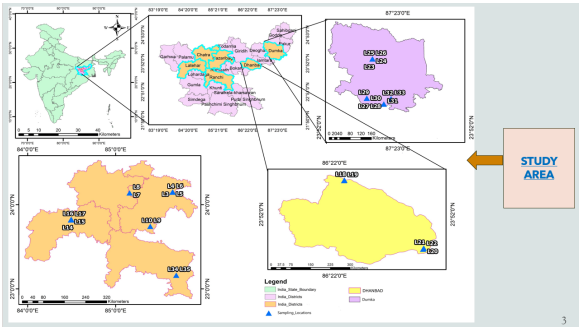


# HYDROCHEMICAL EVALUATION OF THERMAL AND NON-THERMAL WATERS STATE OF JHARKHAND,INDIA

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Geothermal energy being a sustainable, cleaner, and reliable alternative to conventional energy resources offers a promising solution to ever increasing global energy demand. India has around 400 geothermal springs which are clustered into ten thermal provinces owing to their origin, tectonic setting and location. One such geothermal province lies within the Son-Narmada-Tapti (SONATA) lineament and lies in the Indian state of Jharkhand. The geothermal potential of this geothermal province is evaluated. For this purpose, eighteen thermal water samples from the thermal springs spread across the six districts of the state of Jharkhand were collected. Additionally, eight groundwater and seven river water sample from the areas adjoining thermal springs were also collected. The temperature of the thermal discharge ranges between 33-89°C with the Total Dissolved Solids (TDS) ranging between 60.1-1467 mg/L. Our analysis reveals that thermal waters predominantly exhibit a Na-Cl type composition, while groundwater are characterized by a Ca-Mg-$HCO_3$ type. Furthermore, our findings indicate alarming levels of fluoride contamination in both thermal and non-thermal waters, with concentrations exceeding the permissible limit (1.5 mg/L) set by the World Health Organization (WHO). Higher fluoride concentrations are attributed to interaction of groundwater with granitic rocks of Chotanagpur Granitic Gneiss complex. The stable isotope data ($\delta^{18}O$ and $\delta D$ values) indicates that the thermal water is of meteoric origin. The study area lies in the SONATA lineament which has fault systems that reaches to the mantle, and it also falls in the radioactive region (Chaudhuri et al., 2000). Thus ,the deeper circulation of meteoric water along the fault and heating by a combination of mantle derived heat and the radioactive heat seems plausible. The cation geothermometers (Na-K and Na-K-Ca) applied to these partially matured hot springs indicate reservoir temperature ranging between(102-215°C) i.e.low to moderate enthalpy systems and can be used for either for direct applications or power generation.

**Keywords:** Geothermal Springs, Chemistry of thermal waters, Geothermal Energy