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Hydrogeochemical and Isotopic Characterization of Thermal Waters of West Bengal and Jharkhand, Eastern India.

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Decarbonizations of electric energy sector and reduction in the global fossil fuel consumption has prompted an increased interest in harnessing the non-conventional energy resources like solar, wind, biomass and geothermal. Geothermal energy stands out from other renewable energy resources, as it has minimum carbon footprints and provides reliable baseload. In India the geothermal energy development is in nascent stage thus a detailed investigation of geothermal energy resources is very important. The present study focuses on the hydro-chemical and isotopic characterization of thermal waters of the eastern Indian states of West-Bengal & Jharkhand, to evaluate their geothermal potential (Fig. 1).

The thermal waters exhibit an alkaline nature, with pH ranges from 7.92 (Kharasinpur, West Bengal) to 9.54 (Tantloi, Jharkhand), and surface temperatures varying from 43ºC (Dulahi, Jharkhand) to 88ºC (Surajkund, Jharkhand). The thermal water has shown elevated Total Dissolved Solids (TDS) concentrations, ranging from 978 mg/l (Meteldanga, West Bengal) to 1004 mg/l (Kharasinpur, West Bengal) which suggests significant water-rock interaction within the reservoir. Unlike surface water (Ca-HCO_3 type) and groundwater (Na-HCO_3), thermal waters exhibits distinct physico-chemical properties and are characterized by NaCl type composition. A few thermal water sample falls in mature field of the anion variation diagram while other remains in the partially mature field (Fig. 2). Application of chemical geothermometers to mature thermal waters provides the reliable estimates of reservoir temperature while that of the partially mature waters can only give a rough estimate. Silica and cation geothermometers indicate that the overall temperature of geothermal reservoir ranges between 117ºC to 186ºC. Thus, the study area exhibits a medium enthalpy geothermal potential. The stable isotope ratio ($\delta^{18}O$ and δD) of the thermal waters indicate its meteoric origin. The study shades light on the geothermal potential of two states of eastern India and provide valuable insights for future exploration and utilization.

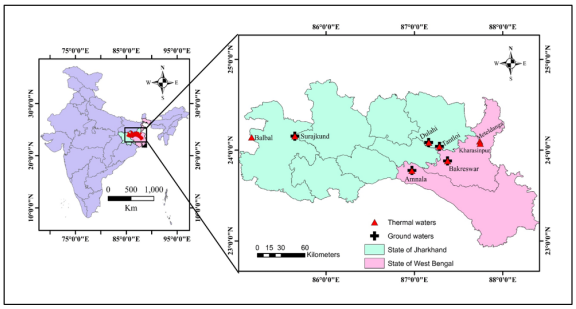

Fig. 1. Map of the state of West Bengal and Jharkhand showing the sample locations. The sample collection sites in each individual thermal area are so close that it is not possible to mark the individual site.

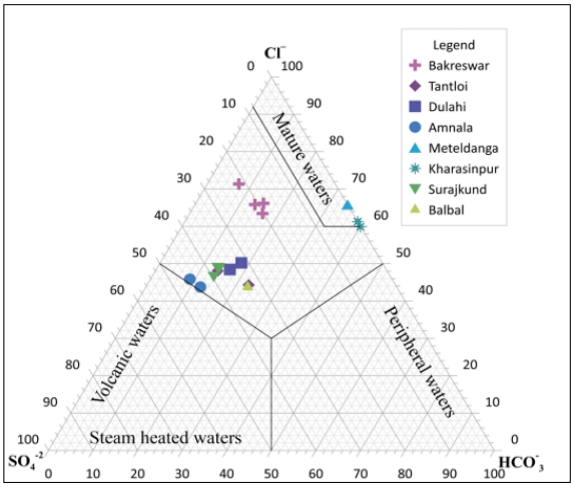

Fig. 2. Anion variation diagram showing the distribution of thermal water samples into different water fields.