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Hydrochemical characterization of Geothermal springs of North-Eastern, India

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India has around 400 geothermal springs. Based on their origin, location and tectonic setting, these geothermal springs are classified into ten geothermal provinces. Among these, the Naga-Lushai and Himalayan geothermal provinces located in the North-East India are very important. Due to their tectonic history and evolution, these geothermal provinces may have high geothermal heat potential. To evaluate the hydrochemistry of geothermal water, their geothermal potential and its relationship with the surrounding water, the thermal and non-thermal water samples were collected. Eleven thermal water samples were collected from the thermal springs located in the Indian state of Assam (Garampani), Meghalaya (Jakrem, Risu), Arunachal Pradesh (Dirang, Kitpi, Phudong and Thingbu). The non-thermal water includes two groundwater and four river water samples collected from the areas adjacent to the thermal springs. All the water samples were analyzed for various physicochemical parameters, major ions, and trace elements.

Thermal water shows distinct characteristics compared to non-thermal water. The temperature of the thermal water ranged between 30-70°C with a high TDS (67.9- 1673.1mg/L). All the thermal water shows neutral to weakly alkaline pH with surface temperature ranging from 30-70°C. The thermal waters are mostly Na-Cl type except for Risu and Phudong which are of Ca-HCO_3 type, similar to the groundwater. All the thermal water except Risu and Phudong has shown fluoride concentration above the WHO permissible limit of 1.5 mg/L. The higher fluoride concentration may be contributed by the hard rocks present in the area. The placement of the hydrochemical data in the Gibbs diagram and Piper plot also suggests intense rock-water interaction and evaporation as the dominant processes in controlling the chemistry of the thermal water. The Garampani thermal water falls in the mature field of the anion variation diagram, while other thermal water fall in partially mature to the immature field. The silica geothermometer applied to Garampani indicates a reservoir temperature of 145.7°C. The cation geothermometers (Na/K, Na–K–Ca and Na-K-Mg) applied to the partially matured thermal water indicate the reservoir temperature ranges between 120-160°C. Thus, the area has low enthalpy geothermal resources which can be utilized for direct utilization purposes.