

Preliminary Geological–Geochemical Evaluation of the Chimborazo Geothermal Prospect Using Remote Sensing

Gabriela Analy Jimbo Cordova¹

¹University Of Guayaquil, Guayaquil, Ecuador

The Chimborazo geothermal prospect (1°60'S, 78°73'W) is located on the northern flank of the Andes and comprises areas of the Western and Eastern Cordilleras and the inter-Andean valley, within the provinces of Chimborazo, Bolívar, and Tungurahua, Ecuador. The study area covers approximately 223,907 m². The objective of this study is to conduct a preliminary assessment of the geothermal potential by integrating geological, geochemical, and hydrogeological data with remote sensing techniques. These datasets were used to characterize thermomineral fluids and their relationships with regional hydrogeological units, following the exploration methodologies proposed by OLADE (1994).

The integration of available information allowed the identification of three geothermal target areas: Cununyacu, located northwest of Chimborazo volcano; Guano–Los Elenes; and Guayllabamba, located southwest of El Altar volcano. Estimated subsurface temperatures range between 77°C and 107°C, suggesting potential applications for agroindustrial processes, heating, aquaculture, and tourism.

In the Cununyacu geothermal system, thermal springs occur within the Latacunga–Ambato hydrogeological unit. The heat source is interpreted to be associated with the Chimborazo volcanic edifice, where the Zumbagua formation could act as a reservoir, while the youngest eruptive phases of Chimborazo may function as a cap rock. Hydrothermal fluids ascend through faults and fractures, emerging as surface springs with temperatures up to 47°C.

The Guano-Los Elenes and Guayllabamba sectors are located within the Chimborazo-Altar hydrogeological unit. In Guano–Los Elenes, the heat source may be related to the Igualata volcanic complex, with Riobamba debris avalanche deposits acting as the reservoir. In Guayllabamba, basement rocks may host the heat source, while the El Altar volcanic units act as the reservoir within a structurally controlled geothermal system.

Hydrochemical analyses show high concentrations of bicarbonate, sulfate, and chloride, and stable isotope data ($\delta^2\text{H}$ and $\delta^{18}\text{O}$) indicate meteoric recharge between 3,700 and 5,900 m above sea level.