ABSTRACT

More than 50% of the energy resources in Switzerland are based on non-local fossil energy, mainly oil and gas. A new Geo-Energy policy based on a gradual transition towards clean and renewable energy resources has been initiated by the Swiss Confederation with the aim of reducing the heavy dependence on fossil fuel energies and emancipating itself completely from nuclear energy. Following the guidelines of the new Geo-energy policy, the Canton of Geneva and Services Industriel de Genève (SIG) initiated the GEothermie 2020 geothermal exploration program in collaboration with the University of Geneva to investigate the Greater Geneva Basin and assess its geothermal potential. Several target areas located in the Canton of Geneva were selected based on preliminary studies, including Laconnex, Troinex, Versoix, Satigny and Bernex. The current study focuses on the Bernex area. Gravity data generated over the study area coupled with Electrical Resistivity Tomography (ERT) and active seismic data were employed to shed light on the subsurface. Analysis of the gravity data highlighted lateral subsurface heterogeneity and thickness variations in Quaternary and Tertiary Molasse and revealed NE-SW anticlinal flexure corresponding to the Bernex hill. Integrating results from ERT and active seismic confirmed the gravity findings and showed a contrast in terms of density, electrical resistivity and seismic facies between NW and SE parts of the study area. Moreover, in the southeastern part of the study area over the Bernex hill, seismic and ERT data showed the presence of faults affecting both Tertiary Molasse and Cretaceous units. The results from this study suggest that the interpreted faults may locally enhance permeability, thereby promoting the circulation of fluids from deeper levels. The discovery of these subsurface elements suggests that the study area may be a potential candidate for geothermal exploration. The gravity method is relatively inexpensive and proved robust in locating lateral lithological variations in the subsurface. However, the non-uniqueness of its interpretation requires data and information based on other geophysical methods such as ERT and active seismic as shown in this study.

Keywords: *Gravity, Electrical Resistivity Tomography, Active seismic, Geneva Basin, Geothermal Energy, Geothermal exploration, GEothermie 2020.*