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# Geothermal energy potential of southwestern of Saudi Arabia "exploration and possible power generation": A case study at Al Khouba area – Jizan

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## ABSTRACT

Saudi Arabia is enriched by many geothermal resources located mainly at the western and southwestern parts. These resources are related to the general tectonic activity of the Red Sea and associated with a series of volcanic rocks and ridges. The Jizan area is considered as a promising geothermal system that includes a number of structural-related hot springs with surface temperature from 46 °C to 78 °C. The present work aims mainly to explore and locate the potentiality of these resources through analyzing the available satellite images, applying a number of geo-indicators and performing a 2D electric geophysical survey, as well as estimating the geothermal reserve potential for possible energy production.

The available ETM, TM 5 and 7 Landsat satellite images are interpreted. A geo-thermometric study was performed to determine the subsurface formation temperature, heat flow and water type. A number of 2D electric profiles are conducted in the study area to investigate the subsurface orientation of the geothermal anomalies. The recorded resistivity data are processed and interpreted to delineate the lateral and vertical configuration of the possible geothermal reservoirs.

This study revealed the presence of many good geothermal anomalies in Jizan province of which Al Khouba geothermal resource is considered the most important. It is characterized by good surface petro-thermal properties (high temperature, up to 78 °C and good flow rate) and promised subsurface characteristics (good vertical and lateral extensions), as well as potential thermal properties.

The estimated thermal parameters are found to be 144 mW/M<sup>2</sup>, 318 kJ/kg and 133 °C for heat flow, discharge enthalpy and subsurface temperature, respectively. A good geothermal potential of 17.847 MWt is estimated for Al Khouba hot spring providing a reservoir area of 1.125 km<sup>3</sup>. We do recommend the official authorities to investment, encourage and support the future scientific research in this area.

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## 1. Introduction

Geothermal resources are considered among other renewable resources (wind, solar, biomass, tidal, etc.) that can be used efficiently for clean energy production [1,2].

These resources, either in the form of subsurface thermal collectives (hot dry rock) or surface hydrothermal hot springs, are considered among the most important sources of renewable energy. The majority of these geothermal resources are concentrated in the western and southwestern parts of the Kingdom, in

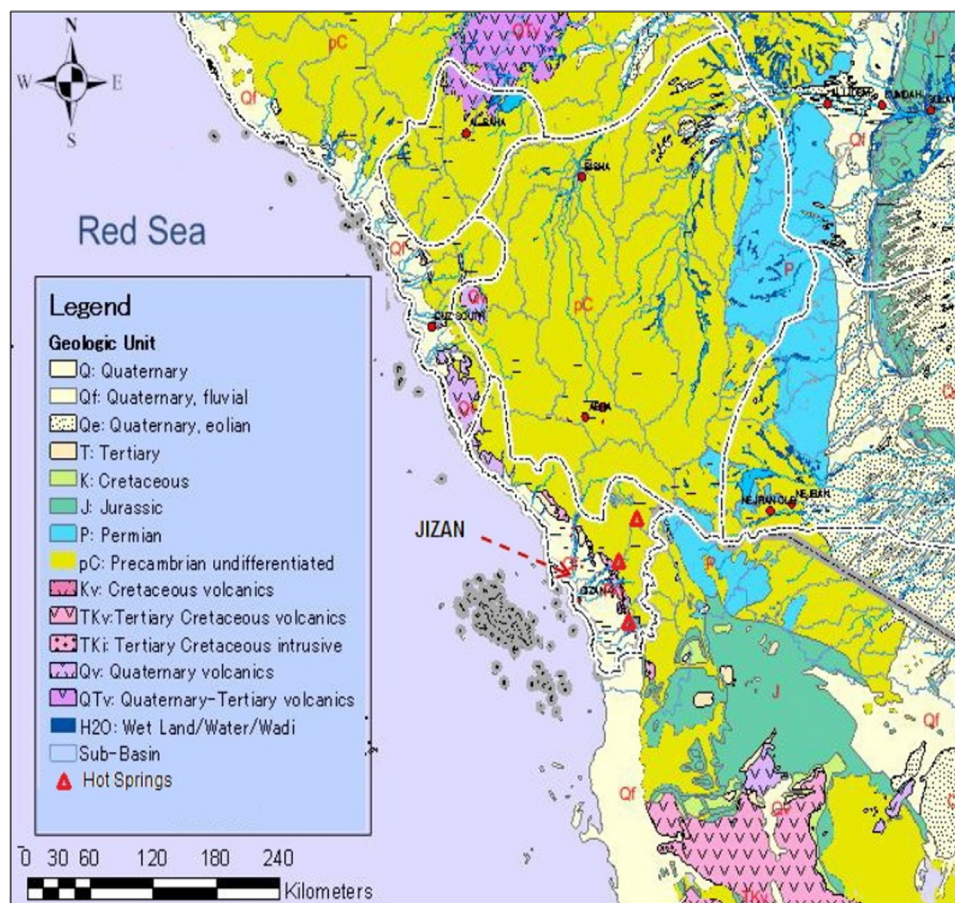


Fig. 1. Geologic map of the Jizan area showing the different encountered rock units.

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