Acta Geochim
https://doi.org/10.1007/s11631-018-0291-6

ORIGINAL ARTICLE

Comprehensive geochemical/hydrochemical and geo-thermometry analysis of Unai geothermal field, Gujarat, India

Manan Shah[1] · Anirbid Sircar[1] · Nahid Shaikh[1] · Karan Patel[1] · Darshan Sharma[2] · Dwijen Vaidya[3]

Received: 1 February 2018 / Revised: 17 July 2018 / Accepted: 31 July 2018

Abstract The knowledge of water temperature produced from a geothermal reservoir and its composition is of utmost importance in designing utilization strategies, the surface production facilities and in selecting the material to be used. Unai hot springs are located in the southern part of Gujarat, India with discharge temperatures varying from 51 to 56 °C. With the aim of developing Unai as a potential geothermal field and exploiting it in the future, geochemical and geothermometrical study was undertaken. The samples were collected from various Unai geothermal location and analysis of chemical composition of water obtained from different wells was done. The concentration of Silica, carbonate and ions like Na and Cl have been analyzed to delineate the path of water movement in the subsurface and classify the reservoir based on the enthalpy. The ratio of the concentration of ions like Na^+ and K^+ and the relative proportions of various sets of ions were also used to characterize the geothermal reservoir and the reservoir fluid by the use of ternary diagrams. Na–K–Ca, Chalcedony, quartz, and Silica geo-thermometers have been studied. The present study also envisages the importance of graphical representations like Piper diagram, Scholler etc. to determine variation in hydrochemical facies and to understand the evolution of hydrochemical processes in the Unai geothermal field respectively. The study yields the conclusion that the reservoir under consideration is a low enthalpy reservoir with temperature ranging from 60 to 80 °C.

Keywords Geothermal energy · Hydrochemical · Geochemical · Geothermometery · Renewable energy

✉ Manan Shah
manan.shah@spt.pdpu.ac.in

Anirbid Sircar
anirbid.sircar@spt.pdpu.ac.in

Nahid Shaikh
nahid.sbt15@spt.pdpu.ac.in

Karan Patel
karan.pbt15@spt.pdpu.ac.in

Darshan Sharma
darshan.sharma@wipro.com

Dwijen Vaidya
dwijen.vaidya@spt.pdpu.ac.in

[1] School of Petroleum Technology, Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India

[2] Wipro Limited, Bangalore, Karnataka, India

[3] Centre of Excellence for Geothermal Energy, Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India

1 Introduction

Numerous geothermal hotspots are found to be scattered over the entire stretch of Gujarat and the density of geothermal hot springs is found to be higher in the Saurashtra and Central region of Gujarat (Fig. 1b). Figure 1a demonstrates various thermal springs located in Gujarat, India.

Subsequent to the breakup of the supercontinent Gondwanaland, the Indian plate moved at very high speed (around 18–20 cm/yr during the Late Cretaceous period) and collided with the Eurasian plate giving rise to the Himalayas 50 Ma ago (Kumar et al. 2007). Currently, it is moving North-East at a speed of 5 cm/yr while the Eurasian plate is moving North at only 2 cm/yr. This is causing the Eurasian Plate to deform, and the Indian Plate to compress at a rate of 4 mm (0.16 in) per year. (GSI

Journal : Large 11631 | Dispatch : 1-8-2018 | Pages : 14
Article No. : 291 | ☐ LE | ☐ TYPESET
MS Code : CJOG-D-18-00013 | ☑ CP | ☑ DISK