Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.31609

Main controlling factors of geothermal energy resources in Gonghe Basin, NE Tibet Plateau, China

BIZHU HE[1], XIAORUI YUN[2], XIJIE CHEN[3], ZHENYU LI[4], ZHIHUI CAI[5] AND RUOHAN LIU[6]

[1]Institute of Geology, Chinese Academy of Geological Sciences
[2]Exploration and Production Research Institute of SINOPEC
[3]Development and research center of China Geological Survey
[4]Institute of Geology, Chinese Academy of Geological Science
[5]Chinese Academy of Geological Science
[6]PetroChina Research Institute of Petroleum Exploration & Development

The Gonghe Basin is located at the junction of the South Qilian, East Kunlun and West Qinling orogenic belts, NE Qinghai-Tibet plateau, the heat source and geothermal reservoir potential of high temperature Hot Dry Rocks (HDR) are enigmas. In this study, the tectono-stratigraphic sequences, deep structural architecture are systematically analyzed, the dynamic mechanism and evolution is discussed, the main controlling factors on the geothermal reservoirs are analyzed. The multi-stage activities of the Wahongshan-Wenquan, Tanggemu, Waligong, Duohemao dextral strike-slip and thrust faults and the Qinghai Nanshan sinistral strike-slip fault intersected or were tangent in the same or inverse direction, resulted in the strike-slip stretching environment during the Cenozoic. Four large tectonic-sedimentary sequences and eight secondary sequences occurred in the Meso-Cenozoic. The evolution of the Gonghe Basin responded to the near field effects of subducting of the Anemaqen Paleotethyan ocean slab, retraction subducting and collisional orogeny; and to the remote effects of the opening and closure of the Neotethyan and the India/Eurasia continental collision. Five-layer deep structural architectures and dynamics of the Gonghe Basin reveal the favorable geothermal resources potential. The mantle upwelling leaded to the upward disturbance of each layer in the crust, triggered the middle and lower crust partial melt bodies and lost the boundary between the upper and middle crust, and superimposed the strike-slip and extensional tectonic environment, formed a short-path and multi-source heating model. Three-stage heating pattern of HDR: 46~15 Ma, initial slow heating; 15~5 Ma, rapid heating; 5-0 Ma, continuous slow heating; the heating route responded the basin-mountain coupling processing. The heat sources of HDR geothermal reservoir controlled by the mantle upwelling and the lower-middle crustal partial melting body; the arc-related granitoids are superimposed with multi-stage activating faults, joins and hydrothermal activities as heat reservoirs and conductions; the overlying huge fine-grained rock layers resisted thermal diffusion as the protectors and heat caps. The regional heat source is all over the basin and the local one (partial melting) is controlled by the mantle upwelling core, forming the intracontinental non-volcanic geothermal accumulation model. The pre-existing macro and micro fracture systems influences the later geothermal energy exploration and development.