Studies to Model Deep Sand Geothermal Zones in Southern China

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Abstract

Existing volumetric methods are often constrained by limited information when projects are in the early stages of development. The objective of this study was to estimate the potential of the geothermal field using a fine-tuned geological model and a 3D digital temperature model. We establish a good geological model of a geothermal field in southern China and thus compute a 3D conductive numerical temperature model. Based on comprehensive analysis and interpretation of the measured drilling and borehole data, regional variation and spatial distribution of thermal and physical properties are both incorporated into the geological model. The results show that the Neogene and Quaternary strata in the study area have an average porosity of 36% and the average thermal conductivity of rocks is 3.15 WmK-1, the Weizhou formation has porosity. with an average temperature of 29% and an average rock temperature of 2.54 WmK-1, the Liushagang Formation has an average porosity of 22% and an average hermal conductivity of 2.21 WmK-1, the Changliu Formation has an average porosity of 13% and an average temperature conductivity of 2.75 WmK-1. Based on the fine geothermal geothermal model, heat is assumed to be conduction, and the results show that the bottom temperature of the Weizhou Formation in the hydrothermal sandstone reservoir is 96168 degrees Celsius, and the high temperature is concentrated. near the tipping point. fault surface, showing that geothermal resources are favorable regions and geothermal energy is $7.89*10^{14}$ J.

Introduction

General knowledge of the thermal flows and thermal structure of sedimentary basins is of essential importance for the understanding of the formation of basins and their tectonic evolution. Most of the sedimentary basins have experienced periods of faulting and thermal subsidence, in which a large number of thermal phenomena are associated, so thermal activities have an important influence on the formation of sediments. sedimentary pools. In addition, thermal history has a decisive influence on many underground resources, such as oil maturity and geothermal resource distribution. Especially in recent years, with the urgent requirement of environmental protection, clean energy is increasingly needed. Geothermal energy is a form of clean energy that exists in sedimentary basins, the volume is very large, so it can be considered as a promising alternative energy source in the future .The use of hydrothermal deep geothermal energy is still in the discovery phase. The development scenario and power system are still incomplete. However, the underground temperature field is the most important basis for assessing geothermal resources and energy development projects. Therefore, setting the temperature field is not only suitable for current resource exploration but also essential for future energy engineering. Overall, the need for accurate thermal information and thermal fields in sedimentary basins is increasing rapidly.

The objective of this study was to investigate the geological structure, reservoir properties and thermolithic properties of the Cenozoic sandstone thermal reservoir in the sedimentary basin, to develop a suitable comprehensive three-dimensional geological model for numerical temperature field simulation, through which the tank field temperature distribution is calculated. Previous studies on temperature field simulations have relied mainly on inverse parametric calibration, which lacks in-depth study of the thermal properties of reservoirs and commonly produces multivariate results. Therefore, estimating the spatial distribution of thermal parameters and calculating temperature variation based on recorded data has been shown to be of considerable value. Our complete 3D geological model is based on the physical properties and thermal parameters of the rock interpreted by laboratory corrected log data. The structural model is inferred from the interpretation of all available seismic reflections. This seismic interpretation data combined with borehole cover data can establish precise layer morphology, layer interaction and fault relationships of the target thermal sandstone. Although the target layer is a deep sandstone reservoir, in order to obtain an accurate temperature field, the upper surface model is defined as the surface of the earth. Because the reservoir is located about 3000 m underground, the top surface topography has little influence on the temperature distribution, the top surface is considered as a flat surface in the model. With the help of more streamlined underground structure and thermal modeling of rock properties, we are able to provide more detailed temperature information, identify more favorable geothermal areas, and calculate the thermal energy of target reservoir.

Conclusion

A 3D temperature model of the study area in the Beibu Bay basin was established. This model contains actual geological information rather than a conceptual model, including structural features interpreted from seismic data and rock properties interpreted from borehole data. This is the first time that detailed characterization of a geothermal reservoir in China has been carried out in a temperature field simulation. From the results of the temperature simulations, the simulation of the steady-state temperature field does not only vary with depth. The characteristics of temperature distribution are related to complex geological conditions such as sedimentary facies, stratigraphic thickness, petrographic changes and porosity. In the temperature distribution control equation, the temperature is mainly controlled by the rate of radioactive heat generation of the rock and the thermal conductivity of the rock. Therefore, the solution and determination of these two parameters is the key for the simulation of the temperature field and the purpose of the study of geological features. Temperatures above 130°C can be used for generate power energy generation. of At Weizhou Fm., , equivonly alepart nt of to the sub-fault tons of zone in standard the subsidence coal. center has this potential. In Liushagang Fm., the capacity of geothermal power is substantial, but the greater burial depth would be a disadvantage of the development. In general, in this geothermal resource, the productive zone is located near the fault downstream. By numerical calculation, a quantitative assessment of the potential of this geothermal resource is given. This geothermal source can generate energy of 2.927×10^{10} J equivalent to 2.7×10^{14} tons of standard cole.

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