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Application Effect of Microtremor Survey Method in the Exploration of Geothermal Resource

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Geothermal resource is one kind of renewable and environment-friendly clean energy which is gaining people's attention. However, geothermal exploration faces many enormous practical difficulties in determining the drilling location of geothermal well thus we still have high risk of successful well. Geophysical probing methods can provide important basis for the location of geothermal well and improve the success rate of geothermal drilling well. Among many geological probing methods that can be used for geothermal survey, microtremor survey method (MSM) [1-3] is a completely new kind of geophysical techniques.

MSM includes microtremor sounding method and 2D microtremor profiling method. The former is applied to divide strata and achieve one-dimensional S-wave velocity structure. The latter can detect the buried structures [2,4,5]. Comparing the drilling well materials of geothermal resource development of Jiangsu province with the microtremor detection results, we can analyze and make a conclusion of the relation between detection effectiveness and geothermal reservoir and heat controlling structure, as well as research the effectiveness of microtremor survey method in different geothermal resource zones.

We take South of Jiangsu geothermal resource zone as an example. We obtain the inversion results from 66 microtremor survey points. These results are further compared with the drilling results in 13 areas. We draw the conclusion that microtremor sounding method has high accuracy to probe the depth of target geothermal reservoir if the layer is good within the geothermal abnormal region. The accuracy is high to probe the interface between Cenozoic and Mesozoic. In the Mesozoic, the layered effectiveness is relatively bad between Cretaceous and Jurassic. The layered effectiveness is relatively good between Triassic and Permian. The S-wave velocity of Cenozoic layer is about 0.4-0.5 km/s. In little areas, the velocity may reach 0.65 km/s. The S-wave velocity of bedrock surface is upper 1 km/s. Microtremor sounding method can accurate probe upper 3km geothermal reservoirs by adjust the size of detection radius in the areas which have better layer.

Microtremor sounding method can provide the S-wave velocity structure of the underground media and determine the velocity interface with the error of 5%-10%. When the known materials such as drilling results can be used to constrained inversion, the detection error can be controlled fewer than 5%. The S-wave velocity structure of the survey point can infer and explain the depth of main geological interfaces. By combining the known materials, we can determine the depth of target geothermal reservoir, which provides critical instruction to drill geothermal well.

In the area that has been chosen as preconcentration geothermal well, we can achieve both several sounding results of microtremor survey points and apparent S-wave velocity section by 2D microtremor

profiling method. It can help us to know the exact position of buried fault structures in horizon. MSM can effective divide the velocity layer in the section of geothermal well and find out the structure - abnormal zones.

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