

ABSTRAK

IDENTIFIKASI STRUKTUR BAWAH PERMUKAAN DAERAH PANAS BUMI MENGGUNAKAN METODE GAYABERAT (STUDI KASUS: GUNUNG SIRUNG, ALOR, NUSA TENGGARA TIMUR)

Oleh
KHOIRUL ASHABI

Daerah Gunung Sirung, Pulau Pantar, Kabupaten Alor, Nusa Tenggara Timur merupakan salah satu wilayah yang memiliki potensi panas bumi ditandai oleh keberadaan manifestasi permukaan berupa fumarol, mata air panas, tanah panas, dan batuan ubahan. Penelitian ini bertujuan untuk mengidentifikasi struktur bawah permukaan, menentukan zona kedalaman anomali regional dan residual, serta memodelkan sistem panas bumi menggunakan metode gayaberat. Data yang digunakan merupakan data sekunder Global Gravity Model Plus (GGMplus) 2013 yang diolah melalui tahapan analisis spektrum, pemisahan anomali regional dan residual menggunakan filter moving average, analisis turunan *First Horizontal Derivative* (FHD) dan *Second Vertical Derivative* (SVD), serta pemodelan inversi 3D. Hasil penelitian menunjukkan bahwa nilai Anomali Bouguer Lengkap di daerah penelitian berkisar antara 70 mGal hingga 145 mGal. Anomali tinggi diinterpretasikan sebagai batuan berdensitas tinggi, sedangkan anomali rendah berkaitan dengan zona sesar, manifestasi panas bumi, dan batuan alterasi. Analisis FHD dan SVD mengindikasikan keberadaan beberapa struktur sesar dengan arah dominan barat laut–tenggara dan barat daya–timur laut. Berdasarkan analisis lintasan, teridentifikasi tiga struktur sesar naik (*reverse fault*) yang berperan sebagai pengontrol sistem panas bumi. Hasil pemodelan inversi 3D menunjukkan distribusi densitas batuan sebesar 2,10–3,10 gr/cm³ hingga kedalaman sekitar 4000 meter. Zona caprock diinterpretasikan memiliki densitas 2,10–2,43 gr/cm³, zona reservoir memiliki densitas 2,44–2,77 gr/cm³, sedangkan densitas tinggi 2,78–3,10 gr/cm³ diindikasikan sebagai sumber panas (heat source). Daerah prospek reservoir panas bumi Gunung Sirung berada di bagian barat daerah penelitian, memanjang dari tenggara ke barat laut pada kedalaman 400–4000 meter.

Kata kunci: panas bumi, gayaberat, Gunung Sirung, struktur sesar, inversi 3D, reservoir.

ABSTRACT

IDENTIFICATION OF SUBSURFACE STRUCTURES IN A GEOTHERMAL AREA USING THE GRAVITY METHOD (CASE STUDY: MOUNT SIRUNG, ALOR, EAST NUSA TENGGARA)

By

KHOIRUL ASHABI

The Mount Sirung area, located on Pantar Island, Alor Regency, East Nusa Tenggara, is one of the regions with geothermal potential, indicated by the presence of surface manifestations such as fumaroles, hot springs, hot ground, and altered rocks. This study aims to identify subsurface structures, determine the depth zones of regional and residual anomalies, and model the geothermal system using the gravity method. The data used were secondary data from the Global Gravity Model Plus (GGMplus) 2013, which were processed through spectral analysis, separation of regional and residual anomalies using the moving average filter, First Horizontal Derivative (FHD) and Second Vertical Derivative (SVD) analyses, and 3D inversion modelling. The results showed that the Complete Bouguer Anomaly values in the study area ranged from 70 mGal to 145 mGal. High anomalies were interpreted as high-density rocks, while low anomalies were associated with fault zones, geothermal manifestations, and altered rocks. FHD and SVD analyses indicated the presence of several fault structures with dominant northwest–southeast and southwest–northeast orientations. Based on profile analysis, three reverse fault structures were identified as controlling the geothermal system. The 3D inversion modeling results showed a rock density distribution ranging from 2.10 to 3.10 g/cm³ to a depth of approximately 4000 meters. The caprock zone was interpreted to have densities of 2.10–2.43 g/cm³, the reservoir zone had densities of 2.44–2.77 g/cm³, while high densities of 2.78–3.10 g/cm³ were indicated as the heat source. The prospective geothermal reservoir area of Mount Sirung is located in the western part of the study area, extending from southeast to northwest at depths of 400–4000 meters.

Keywords: geothermal, gravity method, Mount Sirung, fault structure, 3D inversion, reservoir.