

Identifikasi Basemen di Daerah Panas Bumi X Menggunakan Inversi Tiga Dimensi Data Gravitasi = Basement Identification in X Geothermal Area Using Three-Dimensional Inversion of Gravity Data

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Abstrak

Daerah X merupakan salah satu daerah yang memiliki potensi panas bumi di Jawa Barat ditandai dengan keberadaan manifestasi mata air panas dan hangat di permukaan, serta berada di kawasan vulkanik. Penelitian ini bertujuan untuk mengidentifikasi basemen di daerah panas bumi X dengan menggunakan metode inversi tiga dimensi data gravitasi dan hasilnya diintegrasikan dengan informasi geologi, manifestasi, hasil analisis *First Horizontal Derivative* (FHD). *Complete Bouguer Anomaly* (CBA) digunakan sebagai *data input* untuk inversi tiga dimensi. Hasil analisis CBA menunjukkan kontras anomali tinggi dan rendah berarah tenggara – barat laut, yang mana sesuai dengan *strike* struktur yang berada di kawasan tersebut, dengan anomali tinggi berada di selatan (diduga berasal dari batuan berumur Miosen - Pliosen) dan anomali rendah dominan di utara (diduga berasal dari batuan vulkanik muda yang belum terlitifikasi sempurna). Peta kedalaman basemen diperoleh dengan mengekstraksi nilai densitas dari hasil inversi tiga dimensi CBA. Pemilihan nilai densitas ini didasarkan pada estimasi rata-rata densitas batuan dari Formasi Bentang yang diasosiasikan sebagai basemen di daerah panas bumi X. Berdasarkan analisis peta kedalaman basemen, pengangkatan basemen dominan berada di kawasan Gunung X (zona prospek) diduga akibat keberadaan *heat source* yang mendorong basemen dengan rentang kedalaman 1000 hingga 4500 meter. Basemen dengan kedalaman yang dalam dominan berada di timur dari pengangkatan basemen Gunung X, diduga akibat batuan vulkanik muda yang belum terlitifikasi sempurna cukup tebal di permukaan. Manifestasi panas bumi berada di tepi pengangkatan basemen yang juga berkorelasi dengan struktur geologi, serta hasil analisis kelurusan FHD. Batas tepi pengangkatan basemen dan struktur saling berasosiasi dengan kontras densitas dan diduga membentuk zona permeabel sebagai *pathway* fluida panas bumi.

Area X is one of the geothermal prospect regions in West Java, as indicated by the presence of hot and warm spring manifestations at the surface and its location within a volcanic zone. This study aims to identify the basement structure in the X geothermal area using three-dimensional gravity data inversion, integrated with geological information, surface manifestations, and the results of First Horizontal Derivative (FHD) analysis. Complete Bouguer Anomaly (CBA) data was used as the input for the 3D inversion. The CBA analysis revealed a southeast-northwest trending contrast between high and low gravity anomalies, which aligns with the structural strike direction in the region. High anomalies are located in the southern part, presumably associated with Miocene–Pliocene-aged rocks, while low anomalies are dominant in the north, likely caused by the presence of relatively thick, unconsolidated young volcanic deposits. The basement depth map was obtained by extracting the 2.6 g/cm³ isosurface from the 3D CBA inversion results. This density value was selected based on the estimated average density of the Bentang Formation, which is interpreted as the basement in the geothermal area of X. The basement uplift is primarily observed in the Mount X area (the prospect zone), presumably due to the presence of a heat source that drives the basement upwards, with

depths ranging from approximately 1000 to 4500 meters. Deeper basement is observed to the east of the uplift, likely due to the thickness of unconsolidated young volcanic rocks in that area. Geothermal surface manifestations are found along the margin of the basement uplift, which also correlates with geological structures and lineaments identified from the FHD analysis. The boundary of the basement uplift and associated structures correspond with density contrasts and are interpreted to form a permeable zone that may act as a pathway for geothermal fluid migration.