

Identifikasi Struktur Geologi Daerah Panasbumi Tangkuban Parahu Berdasarkan Data Remote Sensing dan Gravity = Identification Geological Structure of Tangkuban Parahu Geothermal Area Based on Remote Sensing and Gravity Data

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Abstrak

Gunung Tangkuban Parahu yang terletak di sebelah utara Bandung, Jawa Barat mulai dieksplorasi sebagai daerah prospek geothermal sejak awal tahun 1980. Pemboran eksplorasi juga pernah dilakukan hingga kedalaman 620m dengan temperature 50-60°C. Walaupun demikian, hingga saat ini belum ada kemajuan ke tahap pengembangan. Untuk itu, dibutuhkan pemahaman sistem geothermal pada lapangan ini secara rinci dan terintegrasi. Salah satu aspek penting dalam sistem geothermal adalah zona permeabel yang erat kaitannya dengan keberadaan struktur geologi. Oleh karena itu, penelitian ini dilakukan untuk memetakan keberadaan struktur geologi, estimasi temperature, zona permeabel, zona prospek geothermal serta lokasi optimal untuk pemboran. Namun begitu, penelitian ini lebih menekankan pada zona permeabel. Untuk mendapatkan informasi terkait hal tersebut, maka digunakan metodologi analisis remote sensing dan gravity. Teknik pencahayaan pada citra DEMNAS diaplikasikan pada penelitian ini dengan menggunakan delapan sudut pencahayaan yang berbeda. Teknik ini mampu merepresentasikan zona high fracture, dan struktur geologi major pada skala besar. Zona high fracture yang menindikasikan zona permeable dominan terbentuk di sekitar patahan major. Penggabungan data DEMNAS dan composite band 432 dan 567 pada Landsat 8 menghasilkan deliniasi litologi pada daerah ini. Lebih lanjut, teknik turunan pada data gravity yaitu First Horizontal Derivative (FHD) dan Second Vertical Derivative (SVD) memberikan informasi struktur geologi major seperti Sesar Lembang, Sesar Haruman, dan Sesar Ciater di permukaan menerus hingga ke bawah permukaan, adapun beberapa struktur geologi yang tidak nampak di permukaan.

Analisis struktur geologi yang diintegrasikan dengan data MT dan analisis geokimia air menghasilkan model konseptual sistem geothermal di daerah ini. Berdasarkan model konseptual yang dibuat, zona upflow berada di area manifestasi DMS dan CTR, sedangkan zona outflow berada di Utara dan Selatan gunung Tangkuban Parahu. Berdasarkan model MT, zona reservoir berada tepat di bawah puncak gunung Tangkuban Parahu diindikasikan dengan keberadaan dome. Area tersebut memiliki temperature berkisar 240-250°C pada kedalaman BOC -500m di bawah permukaan. Heat source diperkirakan berasal dari sisa intrusi magma. Area optimal untuk pengeboran dari hasil penelitian ini berada pada area sekitar manifestasi DMS dan CTR. Dengan catatan area pemboran ini mempertimbangkan area volcanic hazard (erupsi hidrotermal).

Tangkuban Parahu, located north of Bandung, West Java, has been explored as a geothermal prospect area since the early 1980s. Exploration drilling has also been carried out to a depth of 620m with a temperature of 50-60°C. However, to this day there has been no progress to the development stage. Therefore, understanding detailed and integrated geological conditions are needed. One of the important aspects of geothermal system is the permeable zone, which is closely related

to the existence of geological structures. Therefore, this research was conducted to map the existence of geological structures, temperature estimates, permeable zones, geothermal prospect zone and optimal locations for drilling. However, this study only focus on the permeable zone.

To obtain the information related to permeable zone, a remote sensing and gravity analysis methodology were used. The artificial lighting technique in DEMNAS datasets were applied in this study using eight different sun azimuth angles. This technique is able to represent fracture zones and major geological structures on a large scale. High fracture zone which indicates a permeable zone, predominantly formed around major faults. The combination of DEMNAS data and composite bands 432 and 567 on Landsat 8 have been able to delineate the lithology in this area. Furthermore, the derivative techniques in gravity data, namely First Horizontal Derivative (FHD) and Second Vertical Derivative (SVD) have provide information that some of major geological structures that appear on the surface such as Lembang fault, Haruman Fault and Ciater Fault have continuity to the subsurface, while another geological structures are not visible on the surface.

Integration of structural geological analysis with MT model and water geochemical analysis has produced in a conceptual model of the geothermal system in this area. Based on the conceptual model that has been made, the upflow zone is located in the DMS and CTR areas, while the outflow zone is located in the North and South of Tangkuban Parahu mountain. The reservoir zone is located under the Tangkuban Parahu crater, this is indicated by the presence of a dome in the MT model. The area has temperatures ranging from 240-250°C at a depth of 500m below the surface. The heat source may have been formed from residual magma intrusion. The optimal area for drilling from the results of this study is around the DMS and CTR manifestations. With a note that the drilling location must consider a volcanic hazard area (hydrothermal eruption).