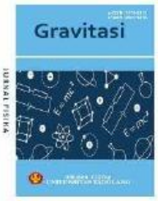
Gravitasi Vol. 21 No. 2 (December 2022) 69-80

Gravitasi

Journal available at: https://bestjournal.untad.ac.id/index.php/GravitasiFisika

e-ISSN: 2654-4318 p-ISSN: 1412-2375



3D Delineation of the Geological Structure at Geothermal Area of Kepahiang, Indonesia

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Information

Article history:

Received: 16 November 2022

Accepted: 30 December 2022
Published: 31 December 2022

Keywords:
3D delineation
Geologic structure
Susceptibility
Geothermal
Kepahiang

Abstract

3D delineation of the geological structure of the Geothermal prospect area in Kepahiang Regency has been conducted. The purpose of the research is to get an overview of the subsurface and geothermal system in Kepahiang and map the alteration zone. Forward modeling and inversion were performed on 194 geomagnetic data measured using a Proton Precession Magnetometer. The results of the analysis found that geothermal field prospects in Kepahiang are distributed in Babakan Bogor, Barat Wetan, Pematang Donok, Tangsi Duren, Sido Makmur, and Air Sempiang with an average reservoir depth of 900 m with an overburden rock type of gabbro (average thickness 1100 m). Four types of rock formations were found including volcanic breccia rocks, basalt rocks, gabbro rocks, and altered rocks. The low anomalies located in Babakan Bogor, Barat Wetan, Kuto Rejo, Pematang Donok, Tangsi Baru, Sido Makmur, and Air Sempiang are thought to be caused by the active and inductively magnetized Musi Segment Fault due to the geothermal reservoir from the activities of Mount Kaba.

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DOI: 10.22487/gravitasi.v21i2.16142

1. INTRODUCTION

One of the geothermal prospect fields in Indonesia which is located in the divergence zone of the continental plate with the Oceanic plate and the magmatic arc of Sumatra Island is in Kepahiang Regency [1]–[7]. The magmatic arc in question is Kaba Volcano [1], [3]. The volcanic activity of Mount Kaba which is in Kepahiang plays an important role in the geothermal system [1]. The prospect of the geothermal field in Kepahiang is characterized by the emergence of several surface manifestations (hot springs, solfatara and fumaroles), neutral pH and rock alteration found around Sempiang Water and the peak of Mount Kaba [4] as well as the presence of low-density values, low resistivity values, and an anomaly of high Hg around manifestation [1] with an area of about 9 km2. The boundaries of the reservoir layer in the geothermal system at Kepahiang are unknown [1], so Sugianto et al. [3] conducted a Magnetotelluric study to observe the geothermal potential in the southwestern basin and next to the position of Kaba Volcano. This research was reinforced by Herlambang and Novranza [5] and Fahmi et al [2] who stated that the geothermal prospect field in Kepahiang was identified in Air Sempiang and Babakan Bogor with an area of 32 km2. The geothermal reservoir is located southwest of Air Sempiang (1750 m underground). The gravity survey also found that the reservoir was detected to have a density of -0.072 gr/cm3 to -0.236 with a depth of 0 meters to 4,705 meters in the vicinity of which 8 faults were found at shallow depths and 4 faults at deeper depths [8].

Lubis et al [9] then investigated the geothermal distribution in the Kepahiang area away from the Kaba Volcano as previously mentioned. It was found that the length of the geothermal distribution in Kepahiang reaches 3000 meters starting from Taba Tebelet to Pagar Gunung with a depth of 1500-5000 meters. The 2.5D reconstruction model also found that geothermal prospects in Kepahiang tend to be distributed around Taba Tebelet, Babakan Bogor and Kuto Rejo. The Taba Tebelet area and the Babakan area are in Bogor. The identified geothermal response is at a depth of 200-2000 m. The high resistivity value comes from the east and northeast which indicates that in fact the geothermal source originates from the Kaba Volcano, contrary to the previous research. So that geothermal manifestations far from Bukit Kaba are volcanic systems in outflow areas. In the geothermal system originating from the upflow activity of the Kaba Volcano, it shows the consistency that the geothermal system in Kepahiang originates from the Kaba Volcano activity which forms an aquifer system that appears in the Babakan Bogor, Kuto Rejo and Taba Tebelet areas due to fractures as the activity of the Sumatran Fault movement .

Maps and models of the distribution of geothermal distribution have been obtained from previous research, but the resulting maps and models examine more geothermal prospect

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areas spatially, namely discussing areas that are suspected of having geothermal presence while a full geothermal study in Kepahiang has not been carried out. In addition, the geological structure in the form of lithology, layers of rock formations for each layer, alteration structures and sources have not been thoroughly discussed. The use of the MT method in previous studies [9] also did not provide good resolution in the shallow subsurface structure layer. Therefore, to obtain maps and 3D geological structure models in the geothermal prospect area in Kepahiang as a whole, this research was developed using the geomagnetic method. The application of this method is based on the value and distribution of subsurface rock susceptibility which is closely related to the structure and geothermal system [9]–[14] in Kepahiang. The magnetic method is a very effective and efficient application for geothermal exploration because it can determine geothermal prospects by looking at the horizontal and vertical distribution based on rock susceptibility values [9], [11], [12], [14-16]. The specific objectives of this study were (1) to map the magnetic anomalies of the geothermal field in Kepahiang, (2) to determine the lithology and rock formations of each layer to the maximum depth obtained from measurements based on rock susceptibility values, (3) the geological structure and its distribution on the administrative map of Kepahiang and its relationship to the activity of Mount Kaba and the Sumatran fault, and (4) the zone of altered rock distribution. This research is a continuation of previous research [17] whose results were limited to mapping the total magnetic anomaly in Kepahiang. This map is still influenced by topographical conditions and has not been reduced to the poles and has not been carried out forward modeling and inversion modeling to obtain the overall geological structure of the geothermal prospect area.

2. TECTONIC ARRANGEMENT OF KEPAHIANG

Tectonically, Sumatra Island is located in a subduction zone (the divergence of the Eurasian plate from the Indian-Australian plate). various activities that occur in this zone such as earthquakes, tsunami phenomena, volcanoes, and other tectonic activities. Along the island of Sumatra, there are rows of volcanoes that stretch from Aceh Province to Lampung Province, following the collision line of the continental plate and the oceanic plate [18]. The existence of volcanoes along this zone is followed by the emergence of geothermal systems scattered in several areas, one of which is the Kepahiang geothermal field. Apart from volcanoes, activity in the subduction zone also produces fractures or long faults on the island of Sumatra, which are called the Sumatra Fault [19]. Therefore, the Kepahiang area is located in the Magmatic Arc region which is accompanied by the appearance of a geothermal system [3-5]. Kepahiang geological conditions can be seen in Figure 1.

Geologically, the Kepahiang geothermal field is part of the complex Kaba volcanic system [4–6], [9], [17]. Kaba Volcano consists of the main parts, namely the remnants of the Old Kaba and Young Kaba eruptions which are located around the remnants of other volcanic eruptions such as Malitan Hill (located southeast), Lumut Hill (northwestern part), and Taba Penanjung (southwestern part). Mount Kaba is classified as an active volcano where apart from the geothermal activity around it, volcanic activity and earthquakes still occur with moderate frequency of occurrence so that Kaba volcanic activity is monitored by the Indonesian volcano monitoring agency. Geologically, the rocks around Mount Kaba are generally of Early Quaternary age [4].

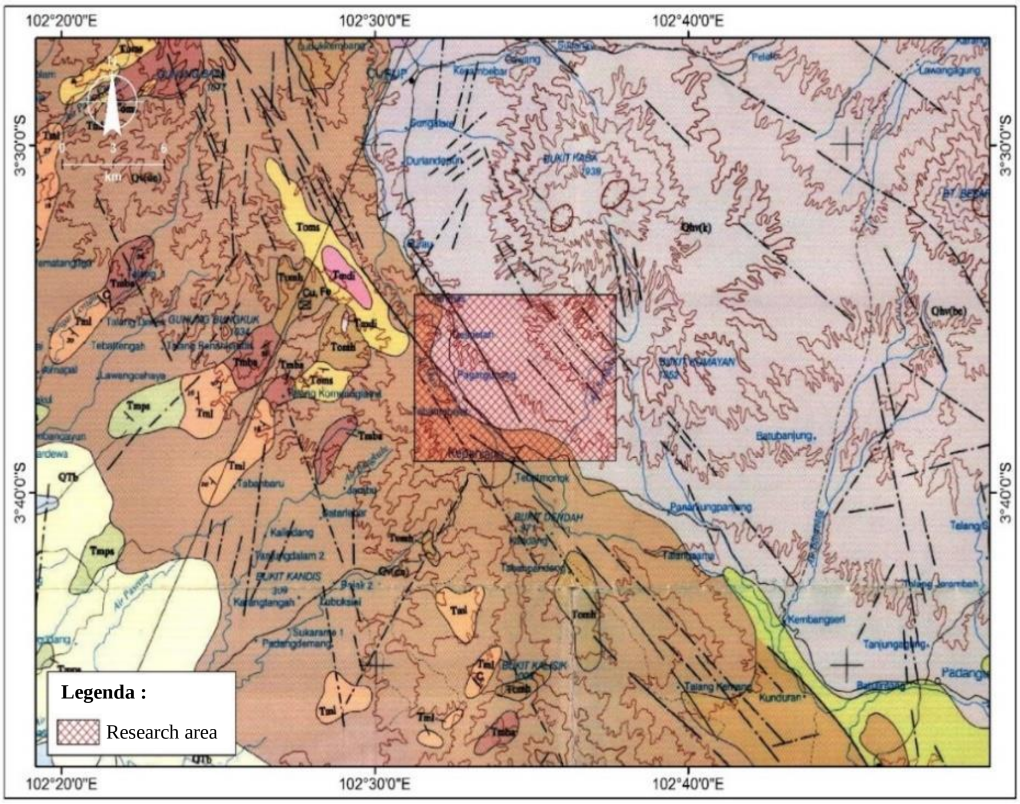

Figure 1. Kepahiang Geological Map (orange box) on the Bengkulu geological map (modified from [18])

3. RESEARCH METHOD

Subsurface structure modeling in the Kapahiang geothermal prospect area has been carried out and is based on the susceptibility value from geogmanetic measurements. Measurement points are distributed in Kepahiang District and Kabawetan District. Measurement of geomagnetic data as many as 194 points spread over the area with an area of 6000 m x 7500 m (Figure 2). Geomagnetic data collection was carried out from 01 September 2020 to 09 September 2020. The data measured by the Proton Precision Magnetometer (PPM) is the total magnetic field value (Htotal) which is measured at each observation point and daily variation data (Hvariance) which is measured at the Base Station.

The subsurface geological structure of the geothermal area in the study area was obtained from modeling rock susceptibility values from various reduction and correction processes to measurement data as well as inversion and forward modeling processes to reconstruct geological structures. Successively, corrections and reductions were made in data processing. IGRF correction and daily correction use the results of previous studies, so that in this study, data processing starts from reduction to the plane and reduction to the poles to the process of forward modeling and inversion modeling. The description of the subsurface structure is based on the susceptibility value of the rocks that cause the anomaly, which is correlated with regional geological maps and the results of previous studies. The distribution of subsurface susceptibility is correlated with the susceptibility value in the forward model to obtain a more absolute subsurface structure. The output of this stage is to obtain a 2D cross-section of the subsurface structure and 2D, 2.5D and 3D contrast models of subsurface rock susceptibility. Applications used in all data processing include Microsoft Excel 2010, MATLAB 2007b, Oasis Montaj, and ZondGM3D. Specifically, the reduction process was carried out using a reduction to magnetic pole filter on the Oasis montaj software.

The maximum depth of the 2D model is determined based on the topography of the study area and previous studies, which is 1500 m below sea level. The future modeling process is carried out using the GM-SYS2D menu on Montaj Oasis with parameters of inclination = -24.5666º, declination = 0.1436º and the earth's magnetic field = 43684.6 nT. Inversion 3D modeling is carried out based on observational data from each line shearc in forward modeling, namely 12 lines. This is done to get a realistic correlation of the results of the inversion model with the results of the forward model. The magnetic inversion process in this study uses a mesh type: general; divede type: automatic and max depth is 2900 masl. The inversion model uses the occam type inversion, options smoothing factor of 0.01 with an iteration of 10. The 3D model of subsurface rock susceptibility is displayed with the Isosurface and Smooth Multi-Slide models.

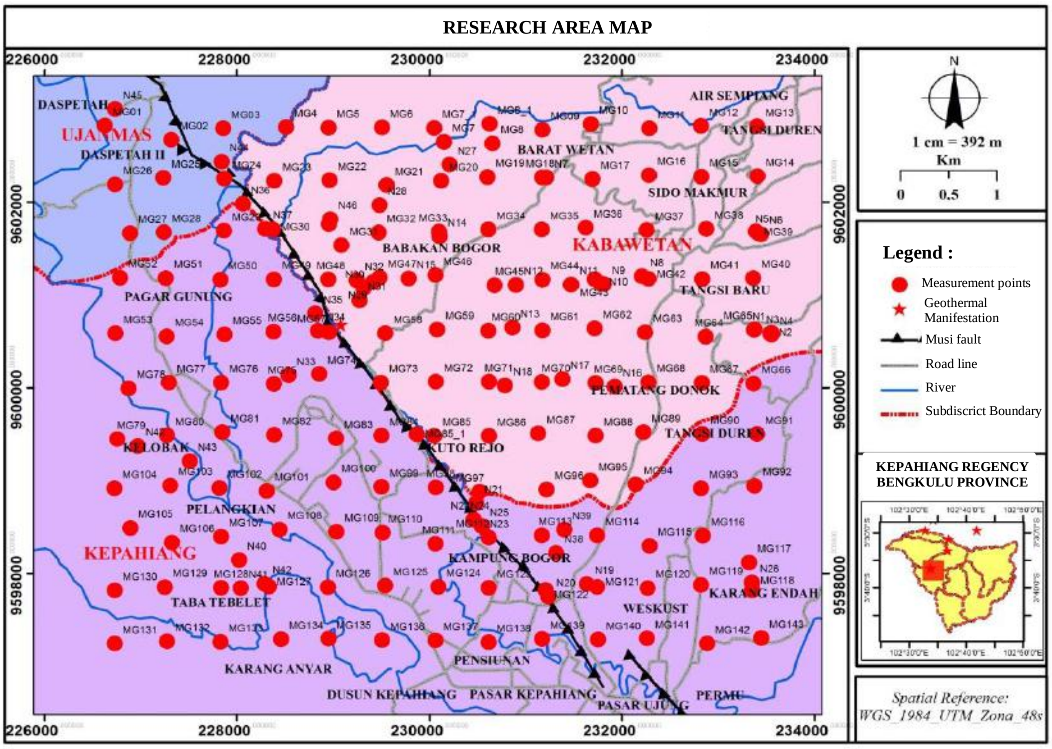

Figure 2. Map of the distribution of geomagnetic measurement points in the Kepahiang geothermal field

4. RESULTS AND DISCUSSION

The total magnetic anomaly from geothermal measurements at Kepahing has been mapped from previous studies [17]. However, this total magnetic anomaly value still has the influence of extreme undulating topographic conditions. Magnetic anomaly values are linear with elevation values so that reduction to a flat plane is carried out using the Taylor series approach to bring magnetic values to the same elevation position [20]. The reduction calculation process to a flat plane is carried out by applying the main parameters, namely the value of Inclination = -24.5666 nT, Declination = 0.1436 nT, Topography = 719 m and equivalent depth sources. The topographical value in question is the height position of the magnetic anomaly data after reduction. The equivalent depth source value in this process is determined by analyzing anomaly patterns which are assumed to be at the same height after the calculation is carried out (Figure 3).

Figure 3 is a graph of the topographical relationship with the total magnetic anomaly and magnetic anomaly reduction to the flat field as a whole in the study area with various equivalent depth sources. This graph shows that the reduction to plane anomaly value is strongly influenced by equivalent source depth. Based on this correlation, it can be seen that the anomaly resulting from reduction with a depth source equivalent to 100 m is dominant in a topography of 590 m with a value of -1441.82 nT to 6508.41 nT, with a depth source equivalent to 350 m dominant in a topography of 710 m with a value of -18 .57 nT to 22 nT while at a depth equivalent to 600 m the dominant topography is 650 m with a value of -13.64 nT to 26.32 nT. So that in this process the equivalent depth of the source is determined by looking at the dominant anomaly pattern in the topography that is close to 719 m, namely at an equivalent depth of 350 m. So that the reduction process to a flat plane uses an equivalent depth source at a depth of 350, the results of which are shown in Figure 4. The figure shows the pattern of distribution of high anomalies (southeast), medium and low. The highest value is 22.0052 nT and the lowest anomaly value is -18.5709 nT.

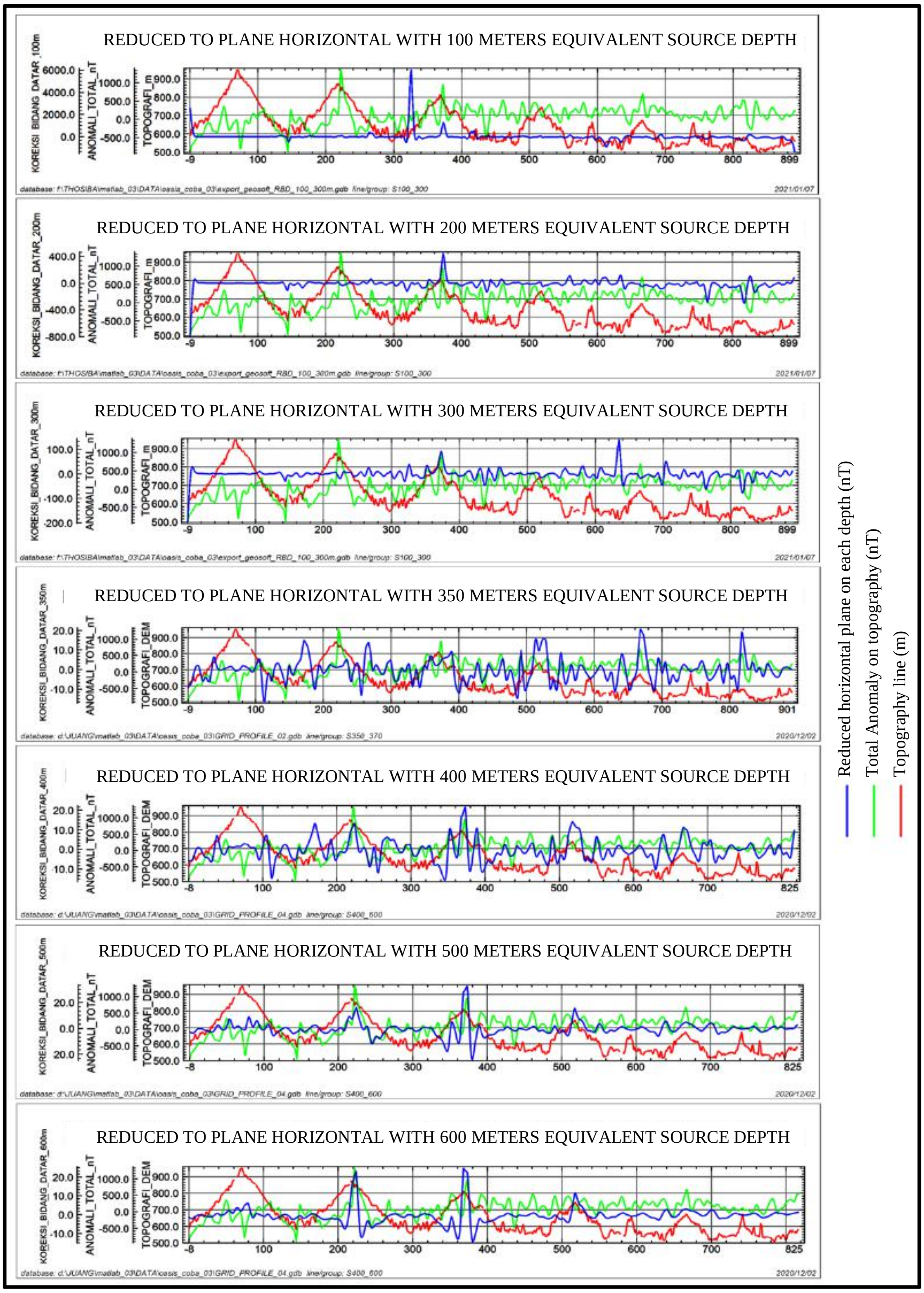

Figure 3. Graph of Topography with Total Magnetic Anomaly in the reduction process to a flat plane at different equivalent depths of sources

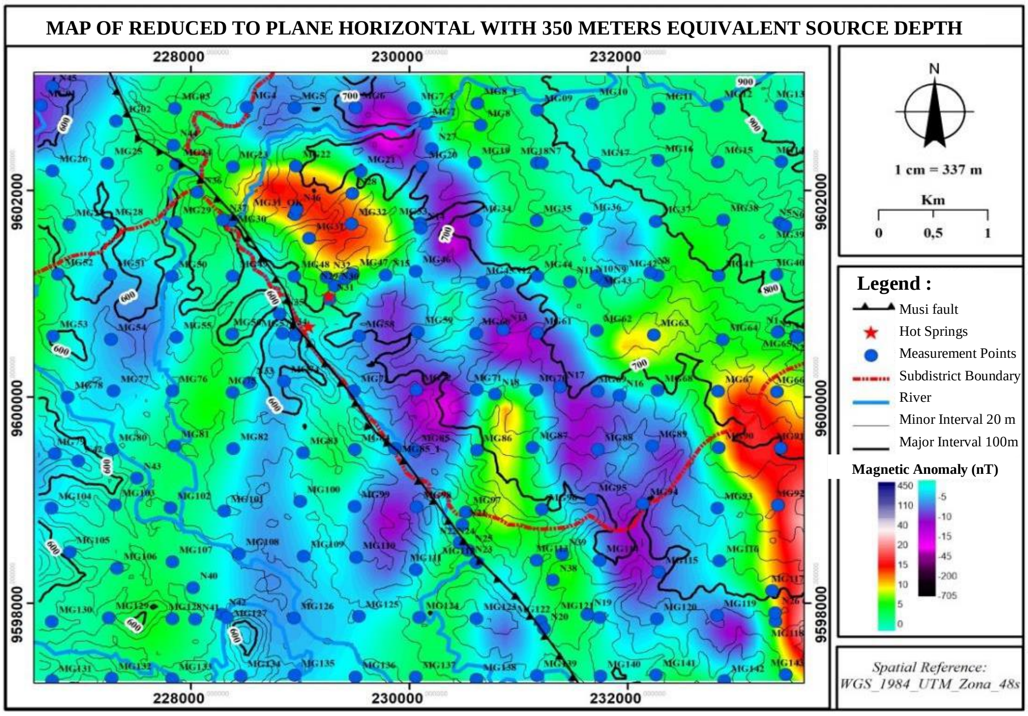

Figure 4. Map of the results reduced to a plane with an equivalent source depth of 350 m

4.1 Reducing Magnetic Anomalies to the Poles

The declination and inclination angles of the study area are 0.14360 and -24.56660 respectively. After being reduced to the pole, the latest declination angle is 00 and the inclination angle is 900. The localization of the anomaly and changes in the pattern of anomalies that have been carried towards the north pole are shown in Figure 5. The distribution of magnetic anomalies varies, where the highest anomaly is in the western part of the Sumatran Fault (Segment Musi) starting from Karang Endah Village, then Kampung Bogor Village, Taba Tebelet, Pelangkian, Pagar Gunung, Daspetah, Daspetah II. The lowest anomaly is in the eastern part of the Musi segment of the Sumatran Fault and the southwest part of Mount Kaba with a magnetic field value of 0 nT to -50 nT. The low magnetic anomaly (blue contour) is distributed in Kuto Rejo Village, then Weskust Village, Kepahiang Hamlet, Pematang Donok, Tangsi Baru, Babakan Bogor, Barat Wetan, Sido Makmur, and Air Sempiang.

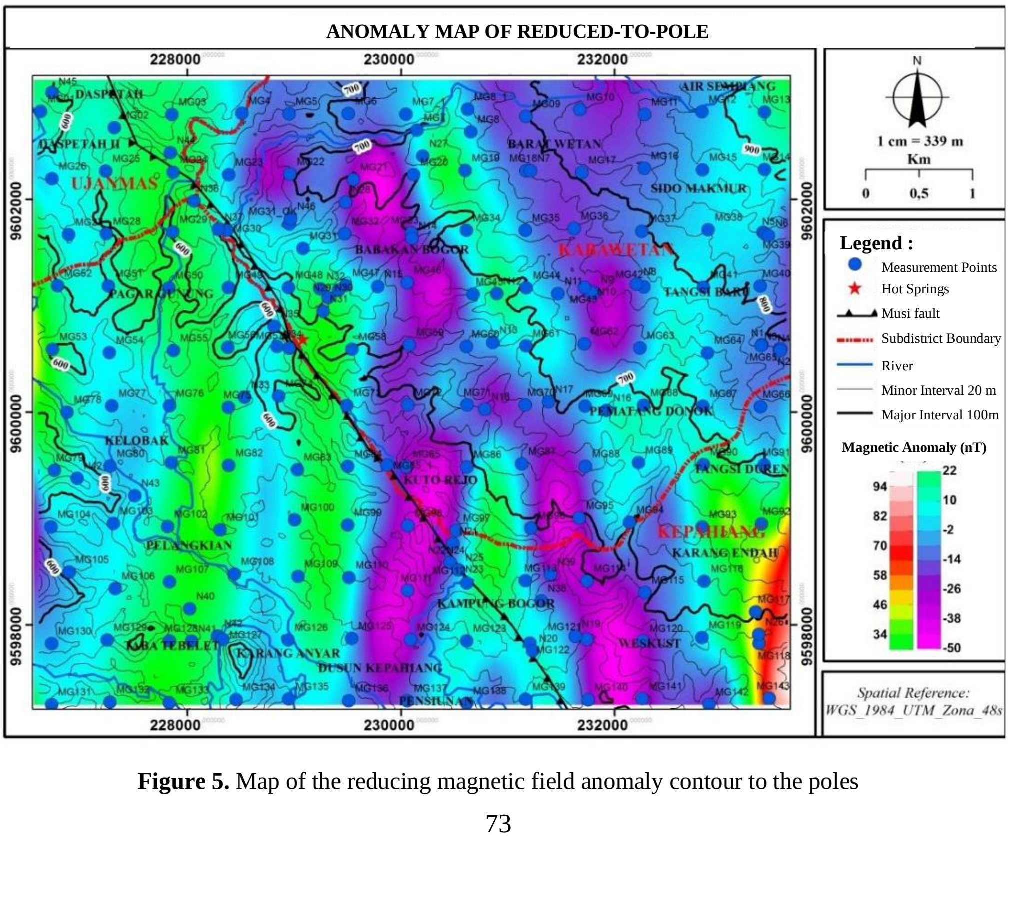

Figure 5. Map of the reducing magnetic field anomaly contour to the poles

The low anomaly has two dominant patterns, namely the first pattern which extends parallel to the Sumatra Fault which branches towards Kepahiang Hamlet and the second pattern extends to the north and northeast. The weak zone (fault) is characterized by a negative magnetic anomaly due to the formation of low magnetic intensity fissures in this zone [4]. So the first anomaly pattern that is parallel to about 2 km from the Sumatra Fault is suspected to be caused by the presence of the fault. The results of the study are also in line with the investigations of Kusnadi et al [4] and Arsadipura et al [1] which state that the Kepahiang geothermal prospect is located to the southwest and south of Mount Kaba. Based on the magnetic properties of the rocks in the geothermal area [6], this area has decreased magnetic properties due to rising temperatures, so the second pattern of low anomalies that extends to the north and northeast is the influence of Kepahiang geothermal energy.

4.2 Quantitative Interpretation of Magnetic Data

4.2.1 Forward Modeling

Future modeling is carried out based on magnetic reduction anomaly data slices to the poles as observation data. The location of the incisions in this model is on the field data collection path with intervals of ±550 m to the south and north. This incision direction was chosen to depict realistic subsurface structural information. Figure 6 is a 2D sectional model of the subsurface structure in the 01-01' slice. The section spans from west to east along 7 km which has positive and negative magnetic observation values with a maximum value of 20 nT and a minimum value of -20 nT. Based on the error value in this incision, which is 0.766, it can be said that the assumption of the susceptibility value and subsurface rock pattern is very absolute. In the 01-01' incision, 6 rock layers were found up to a depth of 2500 m from the topography with different susceptibility values including; rock layer 1 has a susceptibility value of 0, rock layer 2 has a susceptibility value of 0.025, rock layer 3 has a susceptibility value of 0.009, rock layer 4 has a susceptibility value of 0.013, rock layer 5 has a susceptibility value of 0.003 and rock layer 6 has a susceptibility value of -0.008. Based on the geological map and reference rock susceptibility values of 01-01' having rock units Qhv (Mount Kaba) and subsurface rock types with a susceptibility value of 0 can be assumed to be sedimentary rocks, namely volcanic breccias; a susceptibility of 0.025 is assumed to be igneous rock, namely basalt; a susceptibility of 0.009 is assumed to be igneous rock, namely gabbro; a susceptibility of 0.013 is assumed to be igneous rock, namely basalt; a susceptibility of 0.003 is assumed to be an igneous rock, namely gabbro; and a susceptibility of -0.008 assumed to be an altered gabbro.

Administratively the location of the subsurface rock in the 01-01' incision, volcanic breccia (layer 1) is dominant in Kabawetan Village to Air Sempiang Village with a maximum thickness and maximum depth from sea level which is 200 m, basalt (layer 2) is dominant in Kabawetan Village to Daspetah Village with a thickness of 450 m which is at a depth of 450 m, gabbro (layer 3) is dominant in Kabawetan Village to Air Sempingan Village with a thickness of 800 m which is at a depth of -400 m, basalt (layer 4) is dominant located in Daspetah Village, Babakan Bogor Village and Air Sempiang Village with a thickness of 1000 m which is at a depth of -1000 m, gabbro (layer 5) is dominant in Kabawetan Village to Air Sempiang Village with a thickness of 800 m which is at a depth of -1500 m and the dominant altered rocks are from Babakan Village, Bogor to Air Sempiang Village, which is at a maximum altitude of -800 m. Overall structure patterns and rock types are shown in Figure 7.

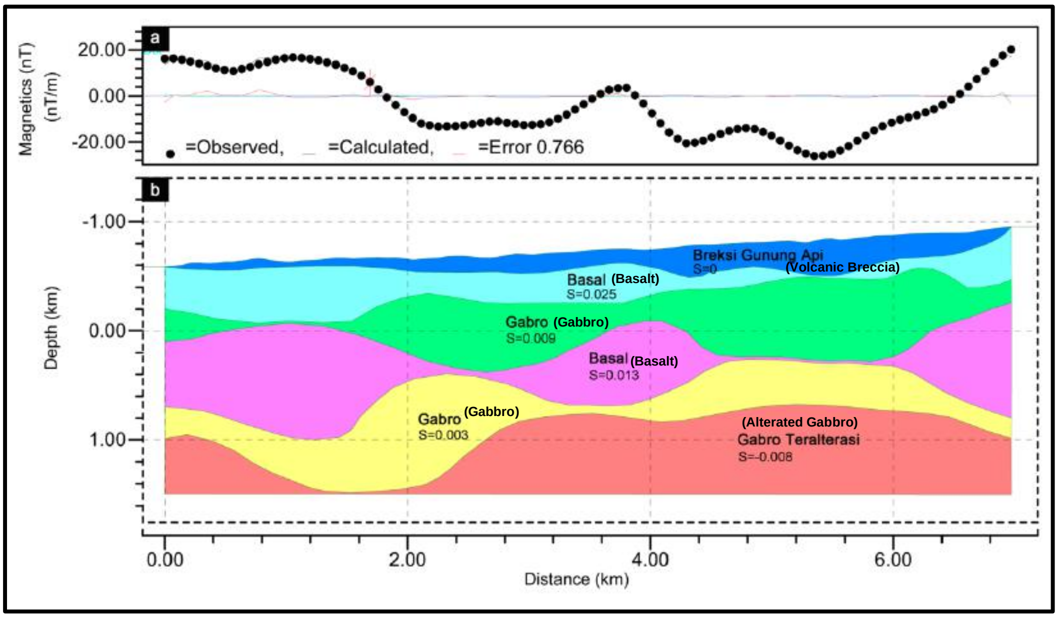

Figure 6. (a) Slice observation magnetic anomaly values 01-01' (b) 2D slice model 01-01' polar reduction anomaly

In the arrangement of incisions (Figure 7a) it is known that the rock types in the study area have the same rock with a pattern relative to the horizontal and vertical. The pattern relative to the horizontal means that the volcanic breccia rock layers in the 01-01' incision are similar to the pattern of volcanic breccias in the 02-02' incision and other incisions, while what is meant by vertical is as in the 11-11' incision The basalt layer pattern is similar to the gabbro layer pattern and the altered rock layer pattern. This relative pattern is clearly visible in the Discover 3D image of the 2D overlay section of the polar reduction anomaly (Fig. 7d). If a correlation is performed in Figure 6 with Figure 7b and Figure 7d, it can be assumed that the Sumatran Fault (Musi Segment) which is still active has contributed to the process of forming subsurface structural patterns in the 01-01' to 12-12' incisions. The rock susceptibility value is -0.008 which is assumed to be altered gabbro in incisions 01-01' to 12-12' caused by the activity of the Kepahiang thermal system and the activity of the Sumatra Fault. Looking at the distribution pattern of the flat reduction anomaly, it can be assumed that the rock is altered caused by the Kepahiang geothermal system by ignoring the influence of the Sumatran Fault in the 01-01' to 08-08' incision, namely the area of Kuto Rejo Village, Pematang Donok, Tangsi Baru, Sido Makmur, Babakan Bogor, West Wetan and Air Sempiang, Kabawetan District.

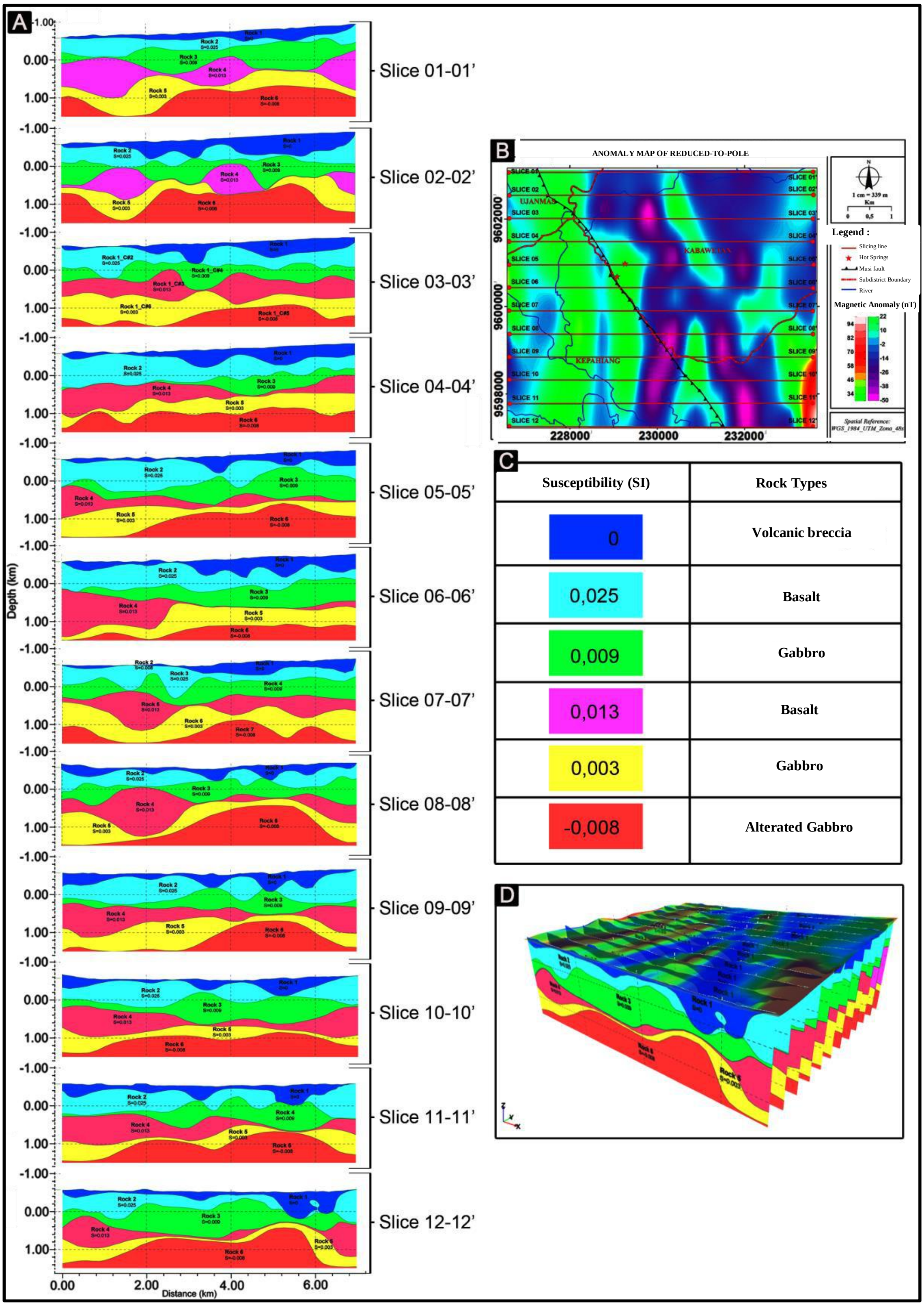

Figure 7. (a) Arrangement of 01-01' to 12-12' Incisions (b) Reducing Anomaly to Pole Overlay of geological data (c) Rock Susceptibility Value and Rock Type in Each Section (d) 3D Discovery 2D section of Anomaly Overlay Reduction to the Poles

In Figure 7, the number of rock layers and the susceptibility values in each section are the same, while the pattern of each layer is relatively different. Based on the susceptibility values in the forward model, rock susceptibility [21] and the geological map of Gafoer et al. [18] it is interpreted that the study area has 6 (six) layers and has 4 (four) rock types to a depth of 1500 masl, namely; layer 1 is a type of volcanic breccia rock, this rock is dominant in the eastern part of the study area; rock layers 2 and 4 are basalt rock types, these rocks are dominantly located in the western part of the Sumatra Fault; rock layers 3 and 5 are gabbro rock types, these rocks are dominant in the eastern part of the Sumatra Fault; and rock layer 6 is the dominant altered rock in the eastern part of the Sumatra Fault. On the polar reduction anomaly map, the altered rocks are in a low (negative) anomaly, namely 0 nT to -50 nT. Regionally, low anomalies are located in the northern, northeastern and eastern parts of the study area (0 to -50 nT), presumably related to the active Sumatran fault (Musi segment) [8] and inductively magnetized due to geothermal activity from Mount Kaba. This result is in line with the research results of Sugianto et al [3], that Air Sempiang and Babakan Bogor are Kepahiang geothermal prospect areas.

4.2.2 Inversion Modeling

Inversion 3D modeling is carried out based on observational data from each incision (line shearc) in forward modeling, namely 12 lines (Figure 9). This is done to obtain a realistic correlation of the results of the inversion model with the results of the forward model. The subsurface rock subsurface 3D model is displayed using Iso-surface and Smooth Multi-Slide models. The 2D forward model cross section overlaid with the inversion 2D section (smooth multi slice) on the 01-01' incision is given in Figure 8.

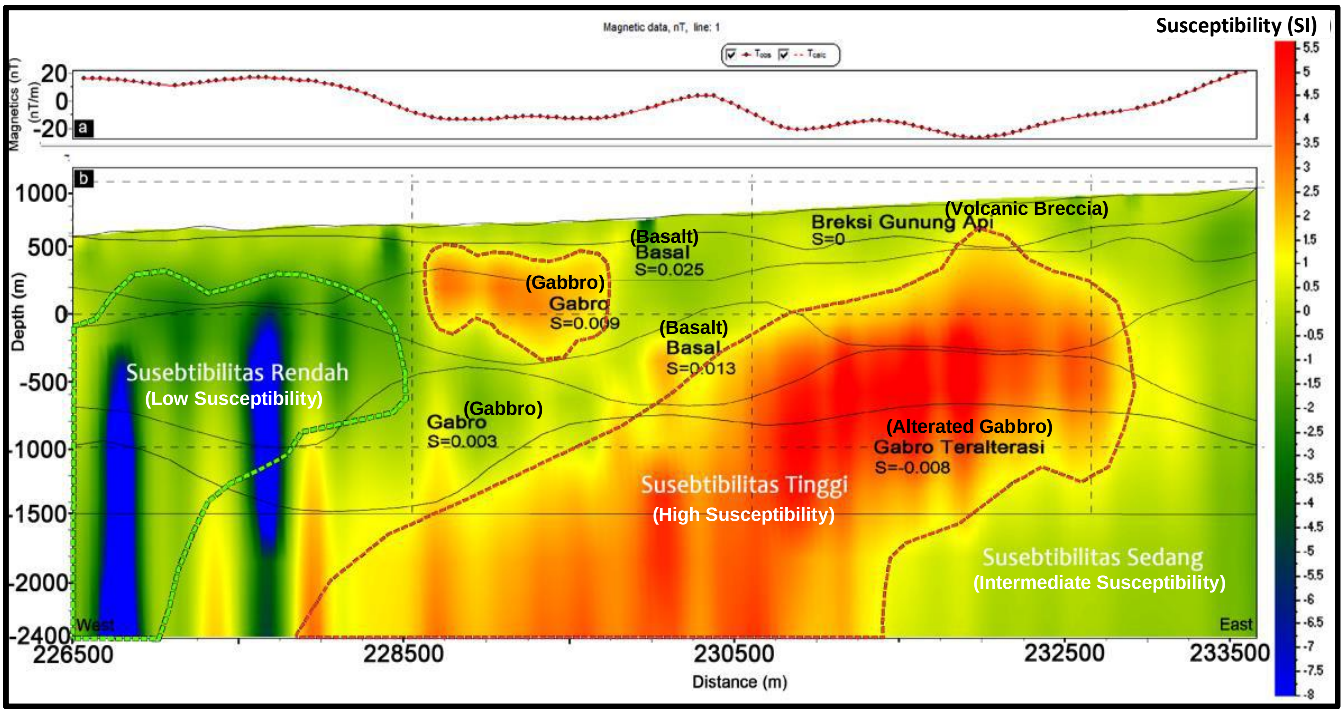

Figure 8. The results of the 2D inversion overlay the results of the forward and inversion models

Based on the results of the 2D inversion in the 01-01' incision (Figure 8), it can be seen that the contrast in the distribution of susceptibility in the model has a pattern of high susceptibility (yellow-red color) and medium susceptibility (yellow-green color) which tends to the east (east) from depth to surface while low susceptibility (green-blue color) spreads at various depths. Looking at the pattern of the distribution of susceptibility values (forward model) overlaid with the contrast of the distribution of susceptibility (inversion model), it is shown that the two models have a relative pattern, where high susceptibility is dominant in the gabbro rock pattern, medium and low susceptibility are dominant in the basalt and rock patterns. volcanic breccia. Qualitative interpretation of the polar reduction anomaly map (Figure 5) 01-01' incision (Figure 8) has positive anomaly values around 0-2 km to the east (Daspetah) and negative anomaly values around 2-4.5 km east (Babakan Bogor and West Wetan). In theory, rocks lose their magnetism when heated to near Curie temperatures [7]. So in line with Sugianto et al [3], the geothermal reservoir is located in Air Sempiang and extends towards Babakan Bogor. In conclusion, such rock properties (negative anomaly values) are caused by geothermal energy. The distribution of the susceptibility values of the subsurface rock for 12 sections of the section is shown in Figure 9. It can be seen that the indications of the presence of altered Gabbro are getting less visible starting from incision number 6 to incision number 11, but in incision number 12 the altered Gabbro rock is starting to reappear. When it is associated with the data on the position distribution of geothermal manifestations on the surface, it is found that the presence of geothermal manifestations on the surface corresponds to the presence of laterated Gabbro Rock. It is suspected that the distribution of the geothermal reservoirs follows the distribution of the presence of Gabbro Rock which is the cap layer in the geothermal system.

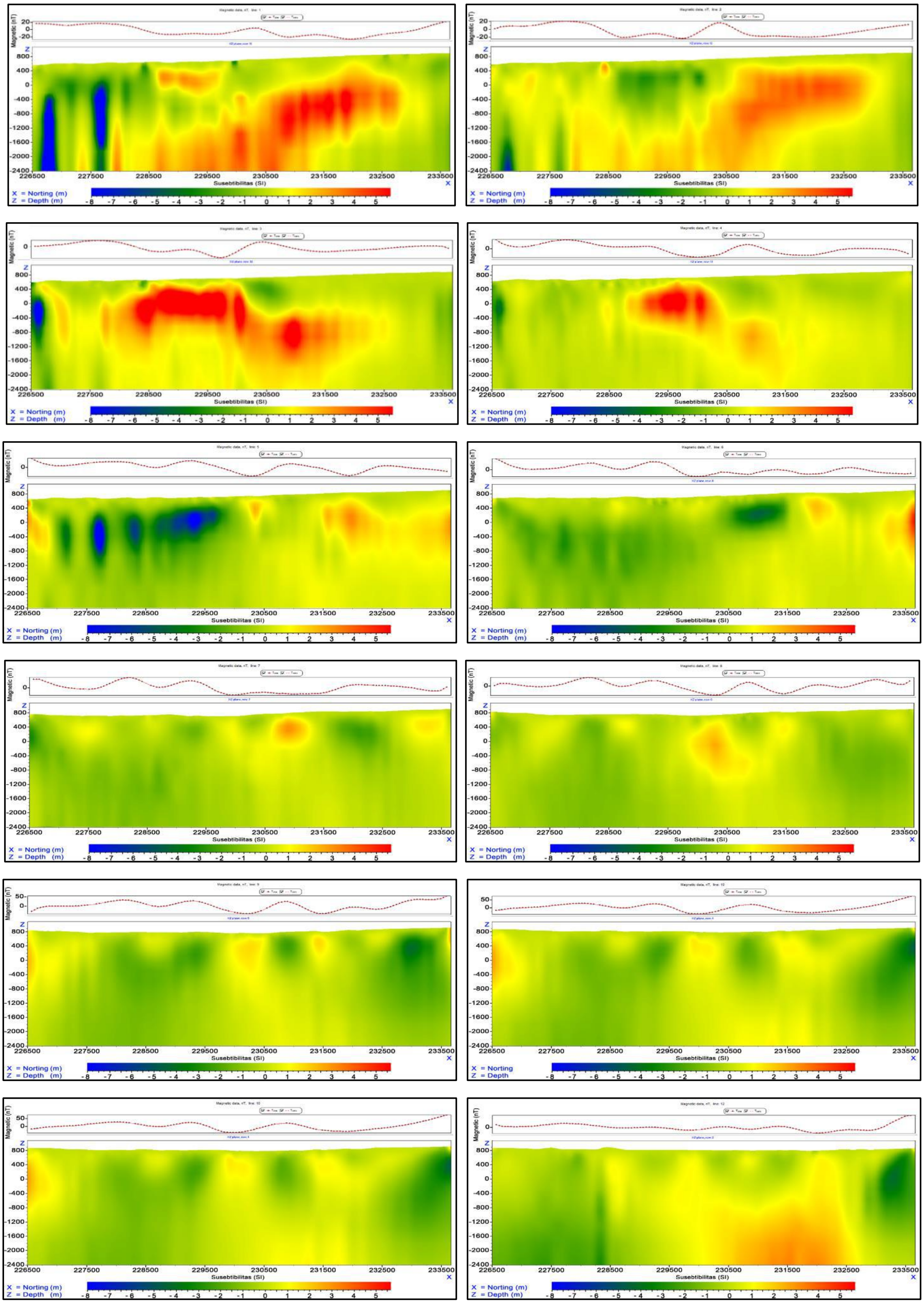

Figure 9. 2D model of rock susceptibility distribution in a 2D cross section of 12 incisions, starting from 01-01' to 12-12' incisions. Yellow-red high susceptibility and green-blue low susceptibility contours

Figure 10 is a 3D model of the distribution of rock magnetic susceptibility in the study area. The susceptibility values spread over the research area are -8.0 to 5.5. Isosurface in this model is used to see the distribution of susibility which has a constant value in the form of space. The susceptibility value on the isosurface is divided into three parts, namely low susceptibility with a value of -0.09 (Figure 10a), medium susceptibility with a value of 0.2 (Figure 10b) and high susceptibility with a value of 1.0 (Figure 10c).

Making a susibility isosurface of -0.09, it can be seen that low susceptibility is spread in the study area which tends to be located in the northwest, southeast, and southwest. While the susceptibility of 0.2 is dominant in the north, northeast, east and south. Based on the isosurface pattern, it is assumed that the pattern with a value of 0.2 fills the empty space on the isosurface with a value of -0.09. Meanwhile, the isosurface with a value of 1.0 (Figure 10a) is dominant in the isosurface pattern of 0.2, in other words, the isosurface pattern with a value of 0.2 is relative to the isosurface pattern with a value of 1.0. Based on the isosurface patterns of low, medium and high susceptibility which are correlated visually with the anomaly pattern of reduction to the poles, it is shown that the isosurface pattern of low susceptibility is relatively high with the anomaly pattern of reduction to the poles. Moderate and high susceptibility isosurface patterns with low anomaly patterns on the polar reduction anomaly map. The smooth multi-slide distribution of susceptibility in this model is used as a correlation material between inversion modeling and forward modeling which aims to facilitate subsurface interpretation.

Furthermore, Figure 11 is a 3D inversion model with an isosurface of 1.0 which is considered to have been referred to in Figure 10. Based on the isosurface 1.0 3D model and the interpretations that have been done, this study justifies Anggini's statement (2019) that geothermal systems those in the Babakan Bogor, Kuto Rejo and Taba Tebelet areas, Kepahiang Regency are the result of the movement of the Sumatran Fault which forms an aquifer system. This is justified because the area mentioned does not have an isosurface in the model.

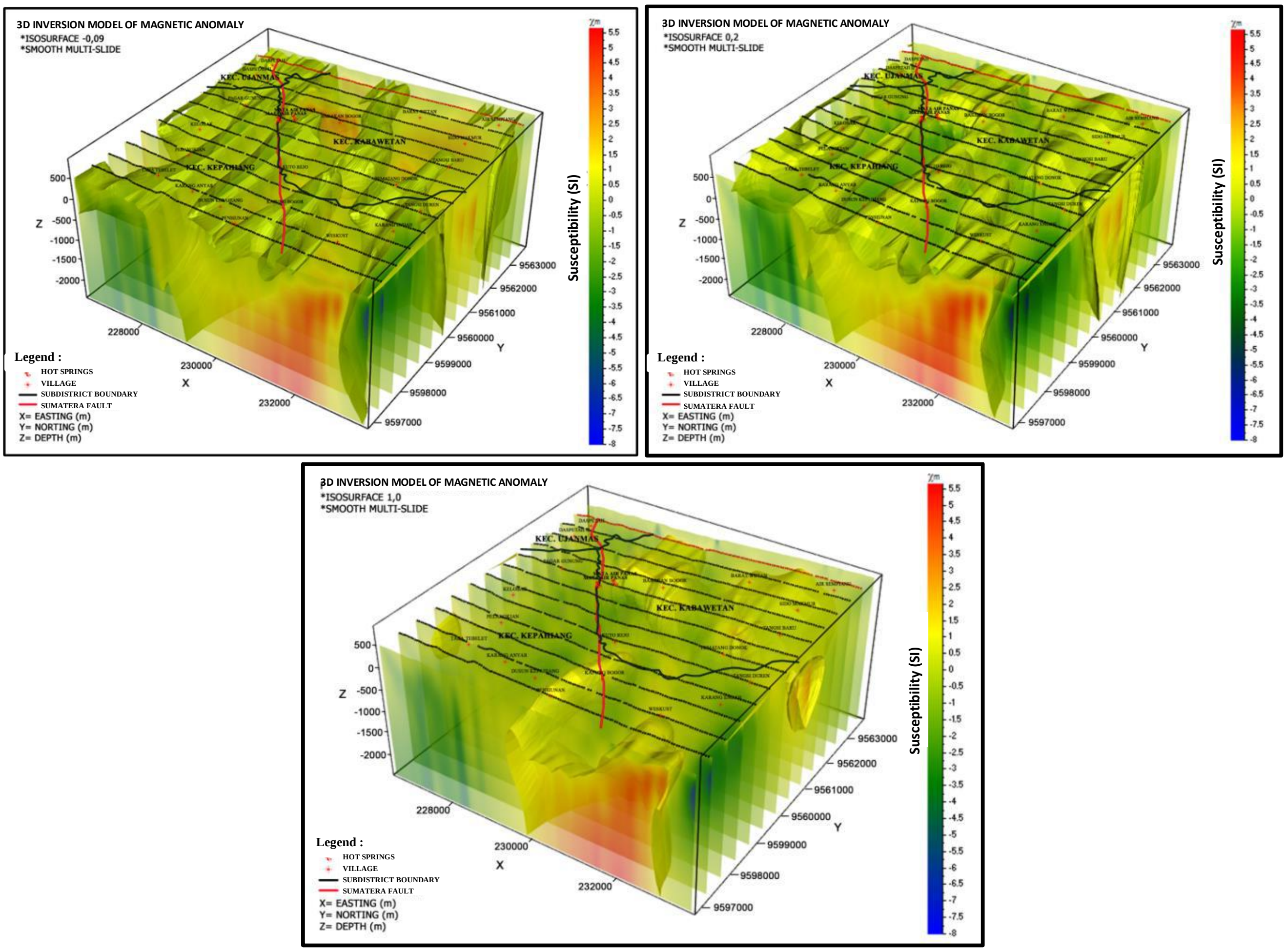

Figure 10. (a) 3D inversion model with a susibility isosurface of -0.09, (b) 3D inversion model with a susibility isosurface of 0.2 and (c) 3D inversion model with a susibility isosurface of 1.0

The findings obtained in this study are the Kepahiang geothermal system which originates from the activities of the Kaba Volcano, namely Babakan Bogor, West Wetan, Air Sempiang, Sido Makmur and Tangsi Baru which lead to the north and northeast (Figure 11) has an area of about 10 km2 in depth of 800 meters above sea level with volcanic breccia, basalt and gabbro rock structures. In addition, from the 07-07' incision to the 12-12' incision negative anomalies were found, altered rock thickness, and the area of the isosurface model which relatively increased towards the south of the study area (away from Mount Kaba). This finding is probably not the influence of Mount Kaba but the influence of the Sumatra Fault or other volcanic activity (not discussed in this study) such as the Sanggul Hill volcanic activity and geothermal manifestations in Taba Padang Village, Seberang Musi District, a distance of about 11 km from incision 07 -07'.

4. CONCLUSION

The subsurface structure of the study area consists of 6 layers with 4 types of rock to a depth of 1500 masl including volcanic breccia rocks (layer 1) which are dominant in the eastern part, basalt rocks (layers 2 and 4) which are dominant in the western part of the Sumatra Fault, gabbro rocks (layers 3 and 5) which are dominant in the eastern part of the Sumatran Fault, and the dominant altered rocks (layer 6) are in the eastern part of the

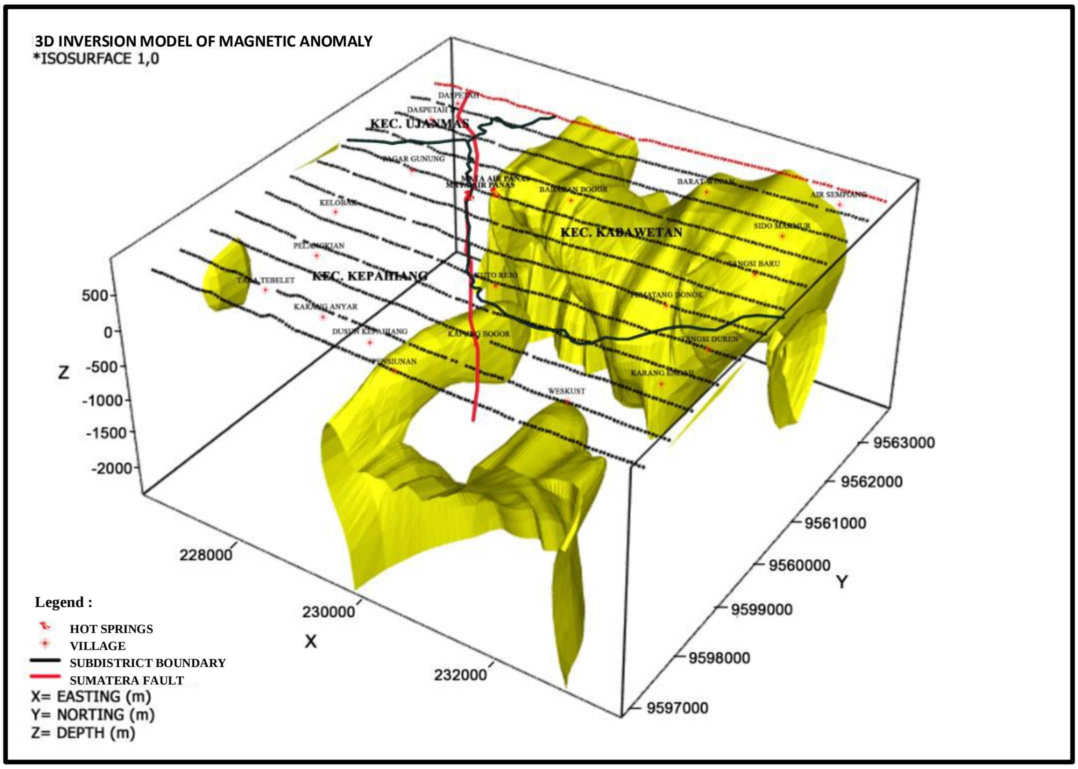

Figure 11. 3D inversion model with a susibility isosurface of 1.0.

Sumatran Fault, gabbro rocks (layers 3 and 5) which are dominant in the eastern part of the Sumatran Fault, and the dominant altered rocks (layer 6) are in the eastern part of the Sumatran Fault. The distribution of magnetic anomaly values on the surface ranges from 0 nT to -50 nT in the Babakan Bogor, West Wetan, Kuto Rejo, Pematang Donok, Tangsi Baru, Sido Makmur, and Air Sempiang allegedly caused by the Sumatran Fault (Musi segment) which is still active and inductively magnetized due to geothermal activity from Mount Kaba. Rocks with altered incisions 01-01' to 06-06' with a susceptibility value of -0.008 in Babakan Bogor, West Wetan, Pematang Donok, Tangsi Duren, Sido Makmur, and Air Sempiang are thought to be inductively magnetized due to geothermal reservoirs from volcanic activity Meanwhile, rocks with altered incisions 07-07' to 12-12' incisions in Kuto Rejo, Bogor Village, Kepahiang Hamlet, Pensiunan, Karang Endah and Weskus are thought to be magnetized due to the movement of the Sumatran Fault which forms an aquifer system. 3D modeling shows that geothermal prospect areas are in Babakan Bogor, West Wetan, Pematang Donok, Tangsi Duren, Sido Makmur, and Air Sempiang with an average reservoir depth of 900 mdpl with a covering rock type, namely gabbro with an average thickness 1100m.

ACKNOWLEDGEMENT

This research was supported by the Physics Laboratory of the Geophysics Division of FMIPA University of Bengkulu in the form of data acquisition equipment. We also thank the Georunners team, Department of Physics.

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