

Chapter 4

Aeromagnetic and gravity data analysis

In this chapter, results of the aeromagnetic and gravity data processing are shown to represent geophysical information. The magnetic data processing consisted of reduction to the pole, reduction to the equator, derivative, analytic signal and upward continuation. The ground gravity data including three parts in the study area were used to support the aeromagnetic interpretation results. The semi-automated depth to basement estimate was accomplished using Euler deconvolution method for both the aeromagnetic and ground gravity data. Finally, the interpretation map was produced from an integration of all the results achieved.

4.1 Aeromagnetic data analysis

Nationwide aeromagnetic data of Thailand used in this study were conducted during 1984-1989 by Kenting Earth Sciences (international) Ltd. (KESIL), based in Ottawa, Canada, under the Mineral Resources Development Project (MRDP) from the Department of Mineral Resources (DMR), Ministry of Industry, Thailand. The aeromagnetic data of the area northeast of Bangkok were obtained from the old magnetic survey conducted in 1979 by Sander Geophysics Ltd., a Canadian company based in Kanata, Canada. The nationwide aeromagnetic grid, with a grid cell size of 500 m and 300 m mean terrain clearance (MTC), was then created by Hatch et al. (1994) during 1993-1994 under the MRDP Phase II.

4.1.1 Aeromagnetic data

An aeromagnetic total field map of the study area is shown in Figure 4.1. A magnetic intensity ranges from 40995 to 42675 nT and has a high value in the northern part of the area including Lopburi, Nakhon Ratchasima and the northern part of Saraburi. Low magnetic intensity occurs in the southern part of the area. Due to the Earth's main magnetic field, the total magnetic intensity map is strongly influenced. There are prohibited areas for an airborne survey such as the Grand Palace where aeromagnetic data are insufficient. The magnetic value in such area was interpolated by software. However, there is not any report about these prohibited areas. In Figure 4.1, NW-SE trending lineament is recognized, especially the anomaly traces in Chonburi. The line-related noise occurs in the middle map, where the survey was flown in the N-S direction. This line-related noise possibly resulted from a poorly leveling of magnetic data. A directional cosine filter is an effective way to eliminate the line-related noise.

According to an International Geomagnetic Reference Field obtained from Thailand's Department of Mineral Resources, Figure 4.2 is the International Geomagnetic Reference Field (IGRF) ranging from 41528 to 42152 nT in the study area. It reflects a geomagnetic data during the data collection and gradually increases from south to north. In order to get a residual magnetic intensity map, the IGRF grid was removed from the total magnetic intensity map (Figure 4.1). After removing the IGRF, the residual magnetic intensity map (Figure 4.3) shows a rather complex crustal magnetization pattern. The residual magnetic intensity ranges from -1013 to 650 nT. A most significant aspect of magnetic anomalies is a high-relief of the

magnetic intensity indicated by “1” and “2” in Figure 4.3. High frequency anomalies in the northern part may reflect a volcanic zone in the area. A second important feature is the NW-SE trending anomaly indicated by “3” in Figure 4.3. This feature represents a fault zone and probably relates to the Three Pagodas Fault. It seems that the anomaly “3” crosses Rayong and Chonburi and then bends westward into Samut Prakarn. This magnetic anomaly marks a continuation of the Three Pagodas Fault Zone coming from north of the Gulf of Thailand, as Morley (2002) has proposed.

4.1.2 Spectral analysis of aeromagnetic data

Radially averaged power spectrum of gridded magnetic data with the grid cell size of 500 m was calculated and analyzed. Figure 4.4 is a radially average power spectrum analysis of the magnetic data set. An upper graph is the log of radially averaged spectrum plots against wavenumber (1/km). A lower graph plots an estimate depth that corresponds to a slope of the radially averaged power spectrum graph in a log scale. The radially averaged power spectrum graph has three fitted lines reflecting very deep, deep and shallow magnetic sources as they are represented respectively by numbers 1, 2 and 3 in Figure 4.4. According to the radially averaged power spectrum graph, a steep gradient slope “1” reflecting very deep magnetic sources has a wavenumber between 0.0 and 0.07 /Km, and its source depth estimated is about 8 to 14 km. A lower gradient slope “2” on the wavenumber between 0.07 and 0.21 /Km gives the estimate depth about 3.5 to 6 km. The graph on the wavenumber between 0.21 and 0.78 /Km responds to the shallow magnetic sources, and a noise component is represented by the graph between wavenumber 0.78 and 1.0 /Km. A limited Nyquist wavenumber in wavenumber domain is 1.0 /Km.

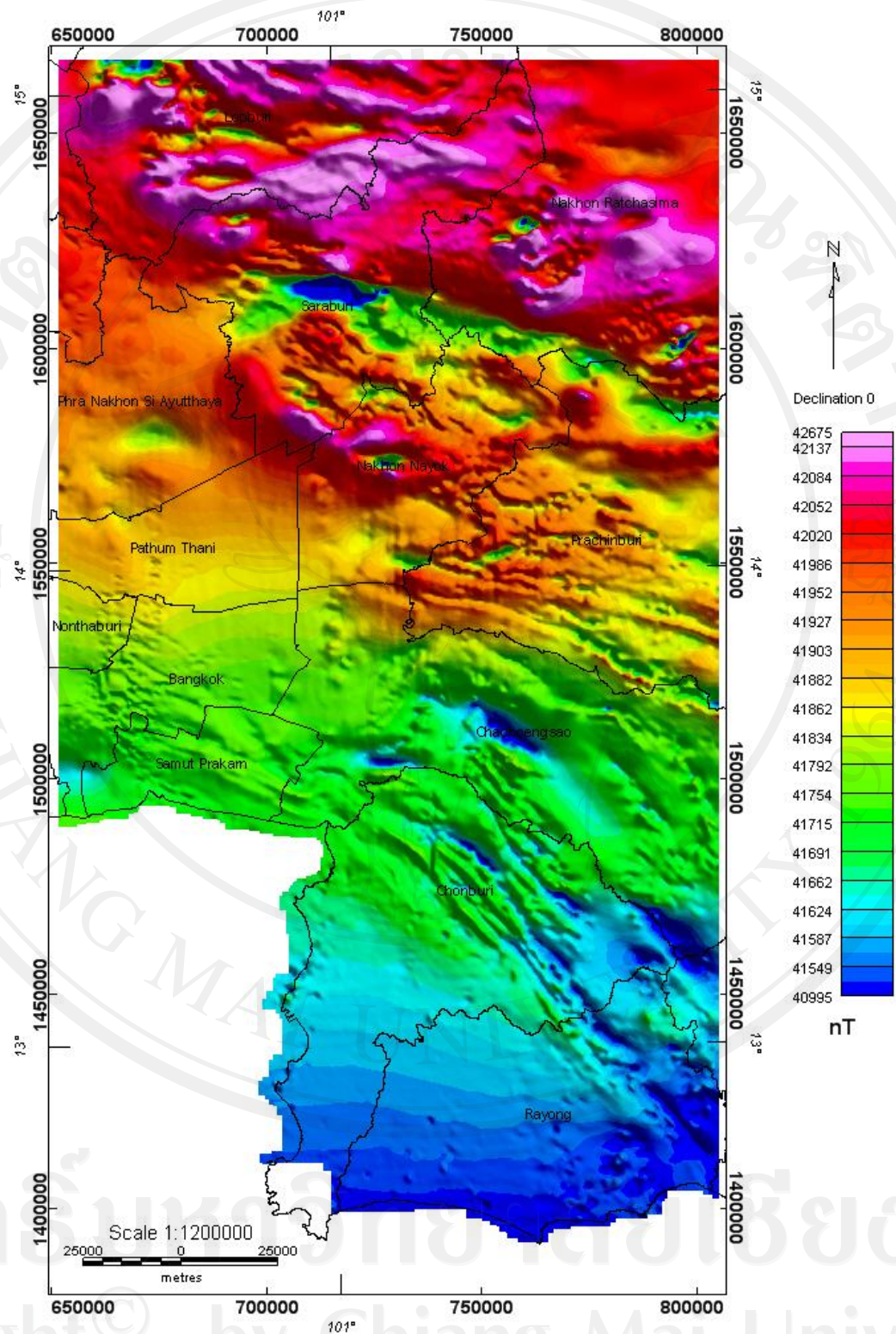


Figure 4.1 Magnetic total intensity map of the study area. A north-south direction noise resulted from a leveling of north-south flight lines occurs in a middle area.

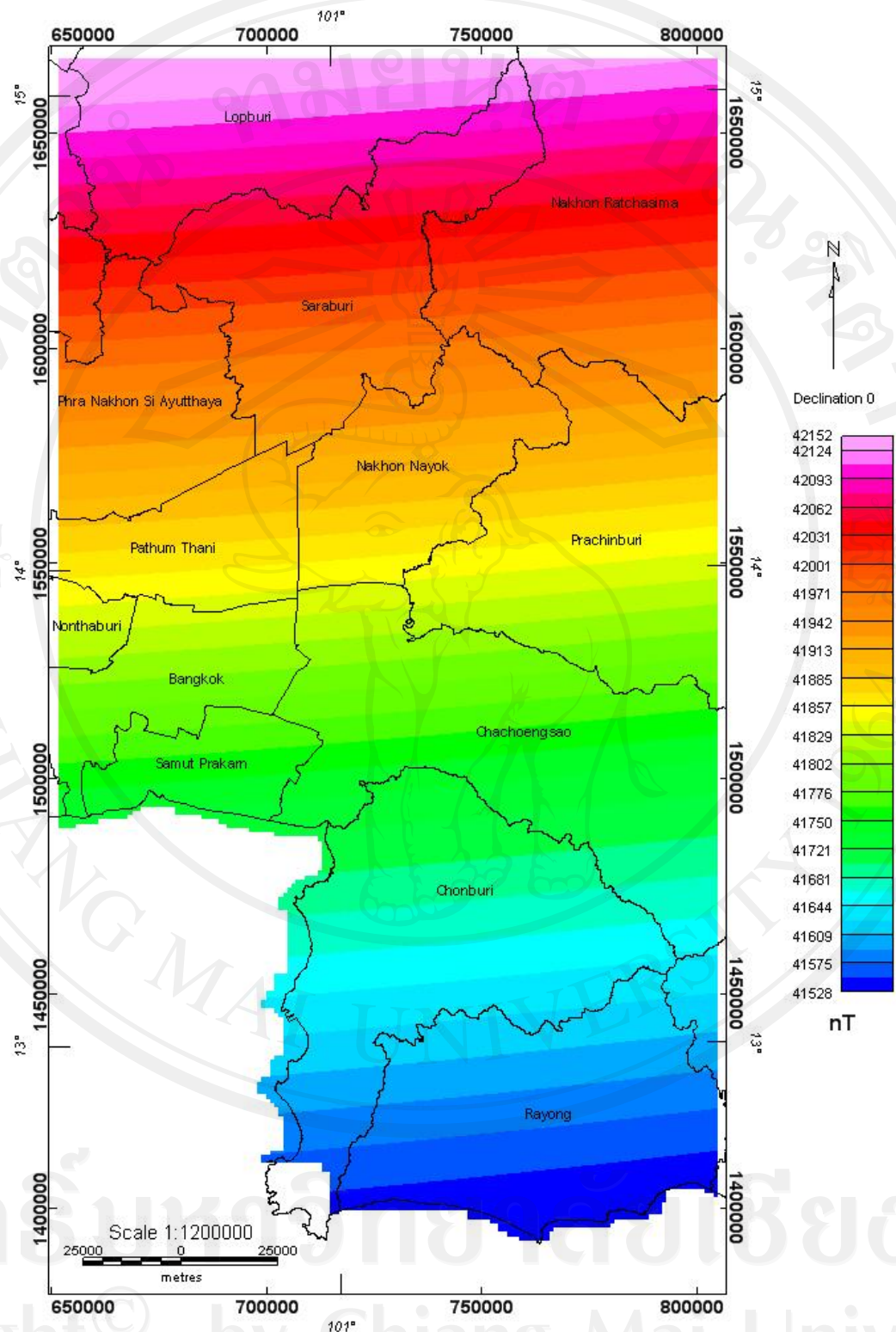


Figure 4.2 International Geomagnetic Reference Field (IGRF) in the study area.

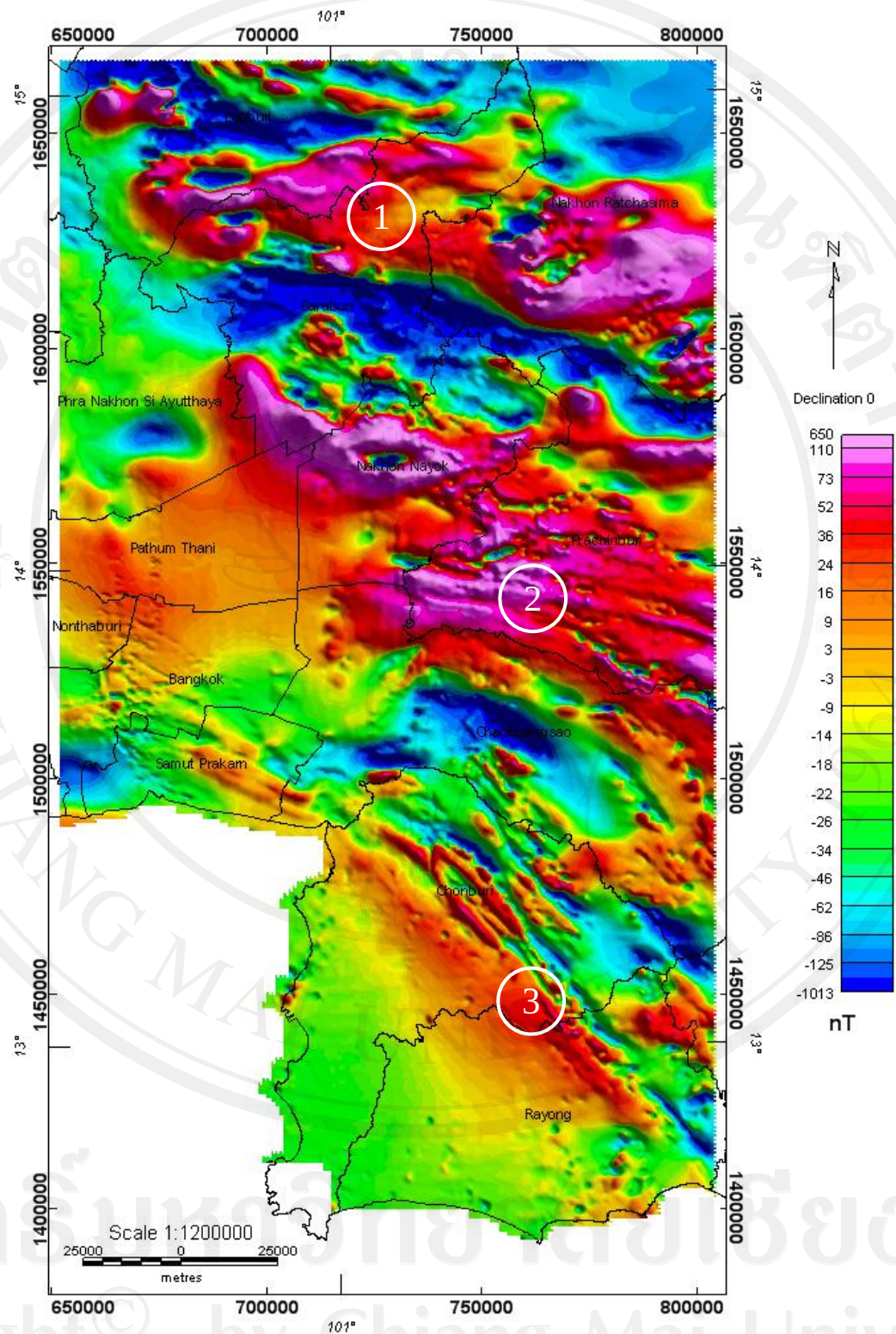


Figure 4.3 Residual magnetic intensity grid after removing IGRF. The number “1”, “2” and “3” indicate the dominating magnetic anomalies represented in the study area.

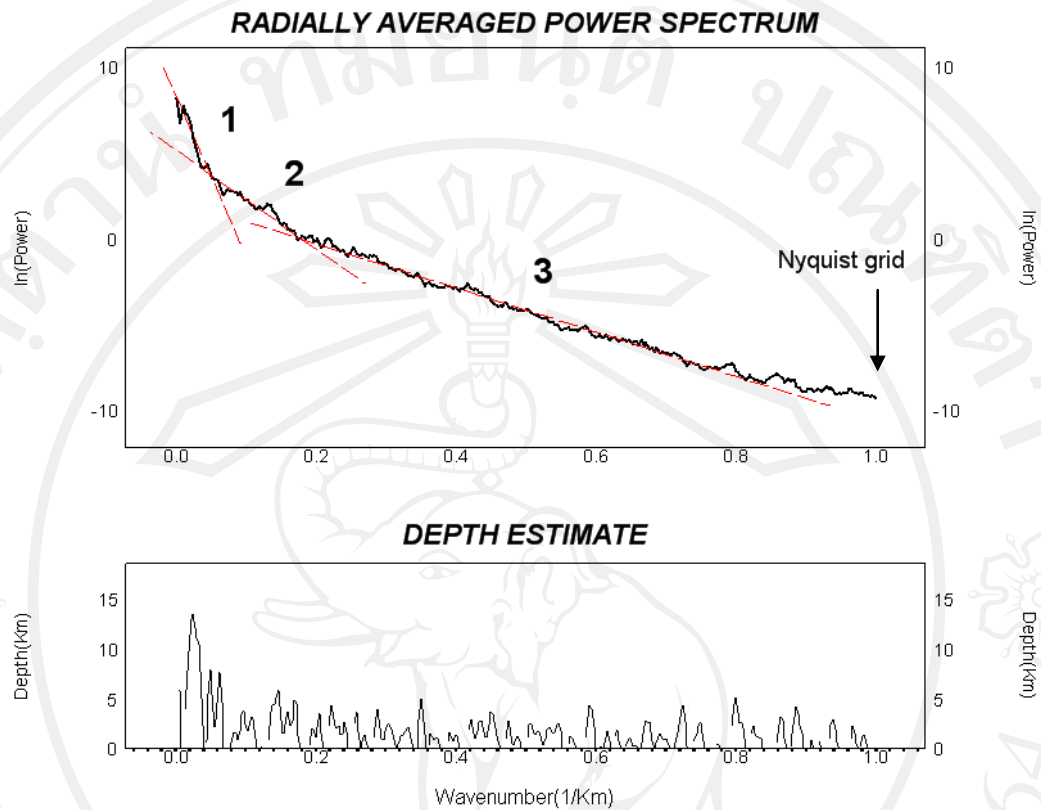


Figure 4.4 Graph of radially averaged spectrum of the aeromagnetic data set. A grid cell size of gridding is 500 m. The number “1”, “2” and “3” are the anomaly components reflecting the very deep, deep and shallow sources.

4.1.3 Reduction to the pole

Reduction to the pole (RTP) was employed in this study to correct a shape of the magnetic data since the shape of magnetic data is usually incorrect when the data are acquired at the low magnetic latitude (inclination angles). The expression of the RTP used in this study is shown in section 3.2.2. Tulyatid (1995) studying the problem of RTP in Thailand tested the RTP operation and set up a proper set of the secondary inclination (I') of Thailand. The suggested secondary inclination (I') of magnetic latitude between 9° and 12° in which the study area is located is 80° . Therefore, this study used 10.5° for the magnetic inclination and 80° for the secondary inclination. The RTP amplifies not only suspect anomalies but also an unwanted noise in the N-S direction (Figure 4.5). The directional cosine filter was, therefore, applied to the residual magnetic map to remove the noise before applying RTP.

Figure 4.6 is the RTP map of the filtered residual magnetic map. Its magnetic intensity ranges from 718 to -565 nT. The RTP map is able to reveal a shape of the magnetic anomalies more clearly than the residual magnetic map. The magnetic anomaly pattern is obviously the NW-SE trending. There are high magnetic relief anomalies that are indicated by “A”, “B” and “C” over Lopburi, Saraburi and Nakhon Nayok. These magnetic anomalies may be considered to be volcanic units that correspond to the Chanthaburi Terrane in Figure 2.4. Sone and Metcalfe (2008) suggested that the Chanthaburi Terrane was originally formed as part of an island-arc system developed along the margin of the Indochina Terrane. There are two moderate magnetic anomalies indicated respectively by “D” and “E” in Phra Nakhon Si

Ayutthaya and near Samut Prakharn. Magnetic anomalies in southern part of Prachinburi indicated by “F” are nearly E-W trending. The high magnetic anomaly “G” over Chachoengsao, Chonburi and the southeastern-most corner of the area represents a fault zone. It is clearly that the magnetic anomalies become more distinct and are easy to be drawn after applying RTP.

Figure 4.7 is the reduction to the equator (RTE) map that reveals opposite sign anomalies in the RTP map. The RTE map looks very similar to the residual magnetic intensity map (Figure 4.3), but it is smoother and less noise than the residual magnetic map. It is because the noise was removed using the directional cosine filter before the reduction. The aeromagnetic data were obtained from the very low magnetic latitude (about 10.5°) or near the equator. As a result, the shape of magnetic anomalies in RTE map is very close to the shape of anomalies in residual magnetic map. The RTE map can show the predominant magnetic anomalies as well as the RTP map.

It is noticeable that, in the visual interpretation, the relief-anomaly map derived from RTP is relatively easier to recognize the high magnetic anomalies than the RTE map. Therefore, the RTP map was mainly used in this study for the magnetic data interpretation.

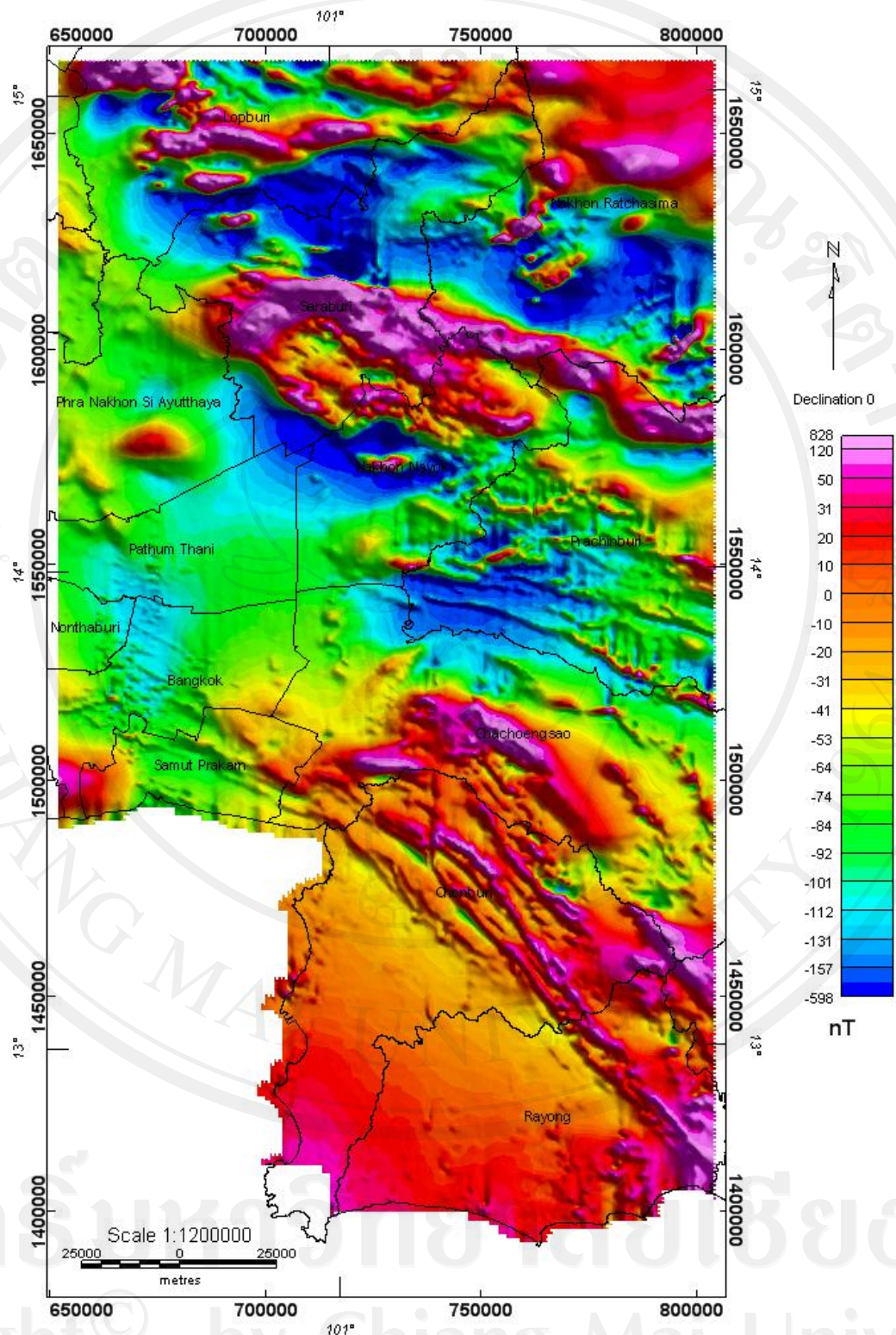


Figure 4.5 Reduction to the pole (RTP) grid of Figure 4.3 without applying the directional cosine filter. The magnetic inclination (I) and secondary inclination (I') were set to be 10.5° and 80° respectively.

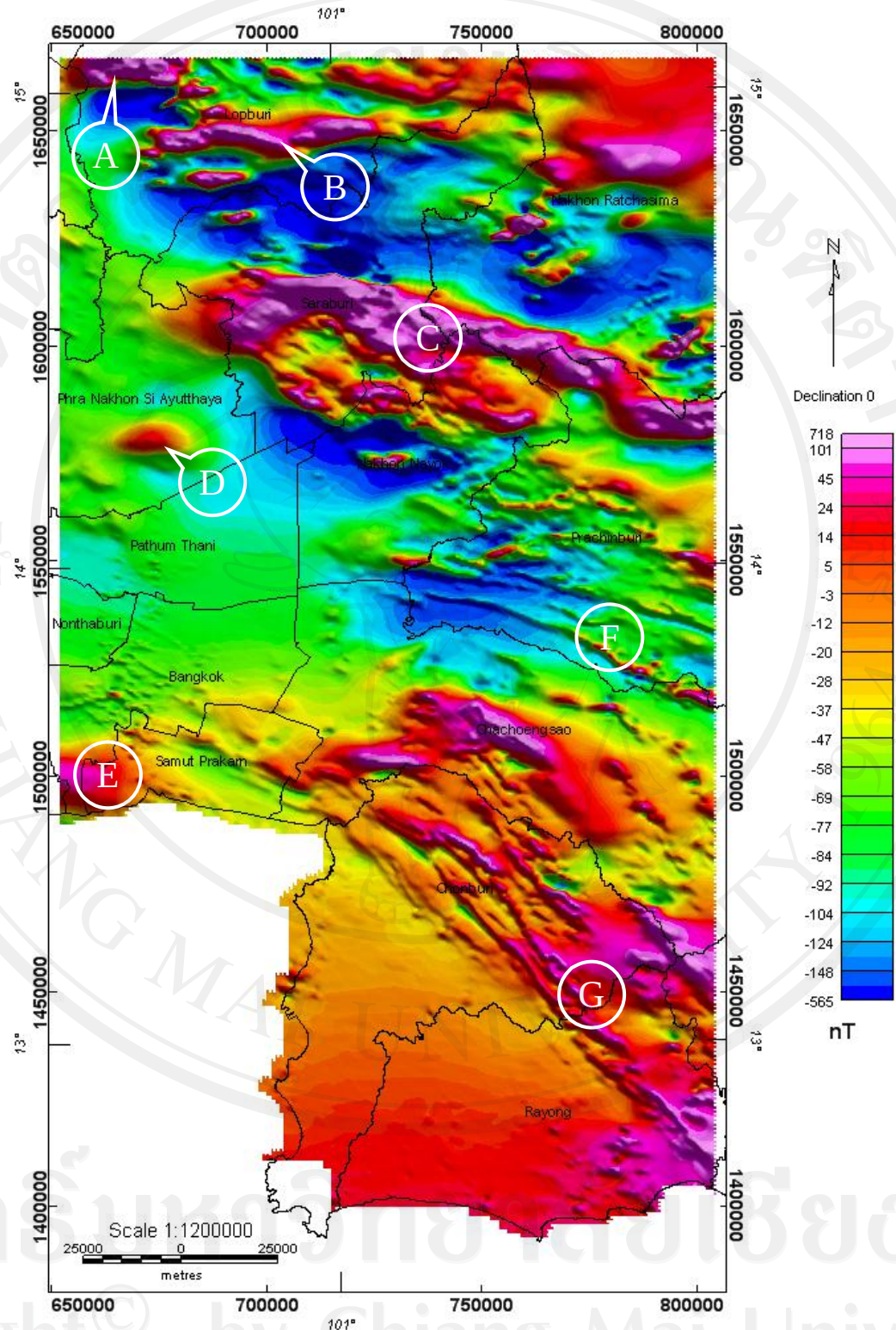


Figure 4.6 Reduction to the pole (RTP) grid of Figure 4.3 with applying the directional cosine filter. The magnetic inclination (I) and secondary inclination (I') were set to be 10.5° and 80° respectively. The letter "A", "B", "C" and "D" indicate the considered volcanic units. The letter "E", "F" and "G" indicate the probable fault zones.

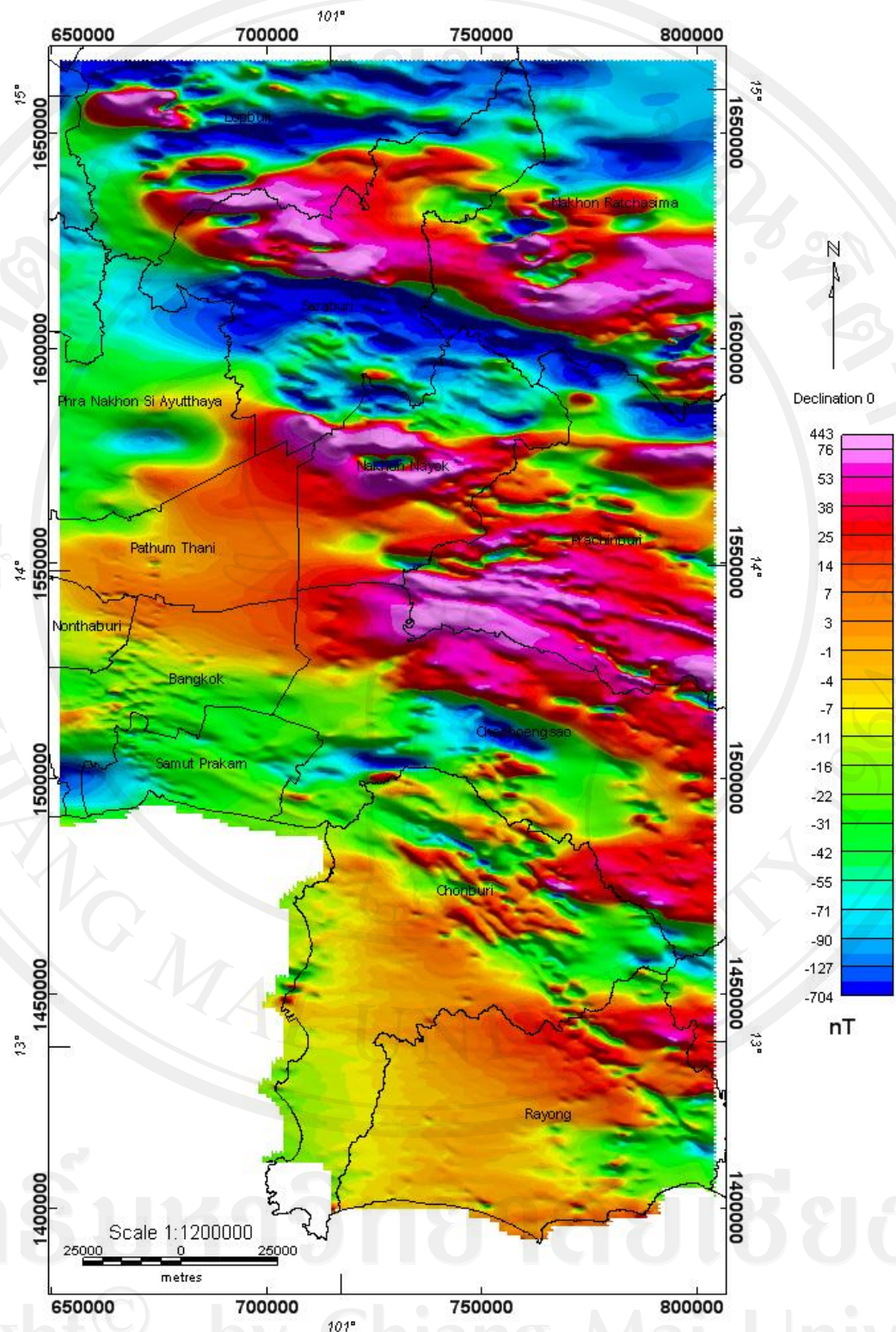


Figure 4.7 Reduction to the equator (RTE) grid of Figure 4.3 with applying the directional cosine filter. The magnetic inclination (I) and secondary inclination (I') were set to be 10.5° and 80° respectively.

4.1.4 Derivative and Analytic signal

In order to enhance the magnetic anomaly, two derivative methods were applied to the filtered aeromagnetic data. They are the first order vertical and horizontal derivatives. A magnitude of the first order vertical derivative is usually highest over a center of magnetic body, whereas it is highest at a border of a magnetic body for the horizontal derivative. The first order vertical and horizontal derivative maps of the RTP grid are shown in Figure 4.8 and Figure 4.9 respectively.

Figure 4.8 is the first order vertical derivative map that reveals a wide spread of short-wavelength anomalies. There is a fault anomaly “F” enhanced in the southern part of Prachinburi. Obviously, Figure 4.8 can show the fault anomaly “G” running in a southeasterly direction across Rayong and Chonburi. The E-W trending noise indicated by “H” occurs in the southern part of the map. It shows a presence of the line-related noise along the E-W direction.

Figure 4.9 is the total horizontal derivative map of the RTP grid in x and y directions. Similarly to the first order vertical derivative map, the E-W trending noise “H” in southern area corresponds to the line-related noise. The fault anomalies “F” and “G” are also recognized as they occur in the first order vertical derivative map (Figure 4.8), but the edges of fault anomalies are enhanced in the total horizontal derivative map (Figure 4.9). There is the very strong anomaly indicated by “I” in Bangkok. It is noticeable that the first order vertical derivative map is able to reveal the fault traces, and the edges of those anomalies can be delineated by using the total horizontal derivative map.

The analytic signal of the RTP grid is shown in Figure 4.10. It reveals predominantly NW-SE trending high anomalies crossing Lopburi, Saraburi, Nakhon Nayok, and Prachinburi. The rounded anomaly indicated by “D” is recognized in Phra Nakhon Si Ayutthaya. The map does not show the continuation of the anomaly “F” in the southern part of Prachinburi, whereas the derivative maps show. The fault anomaly “G” and the line-related noise “H” still occur in the map similarly to the first order vertical derivative map (Figure 4.8). The anomaly indicated by “I” in Bangkok probably relates to the artificial objects, such as power lines and buildings, which affect a magnetic survey. Both magnetic anomalies and noise were enhanced in the analytic signal.

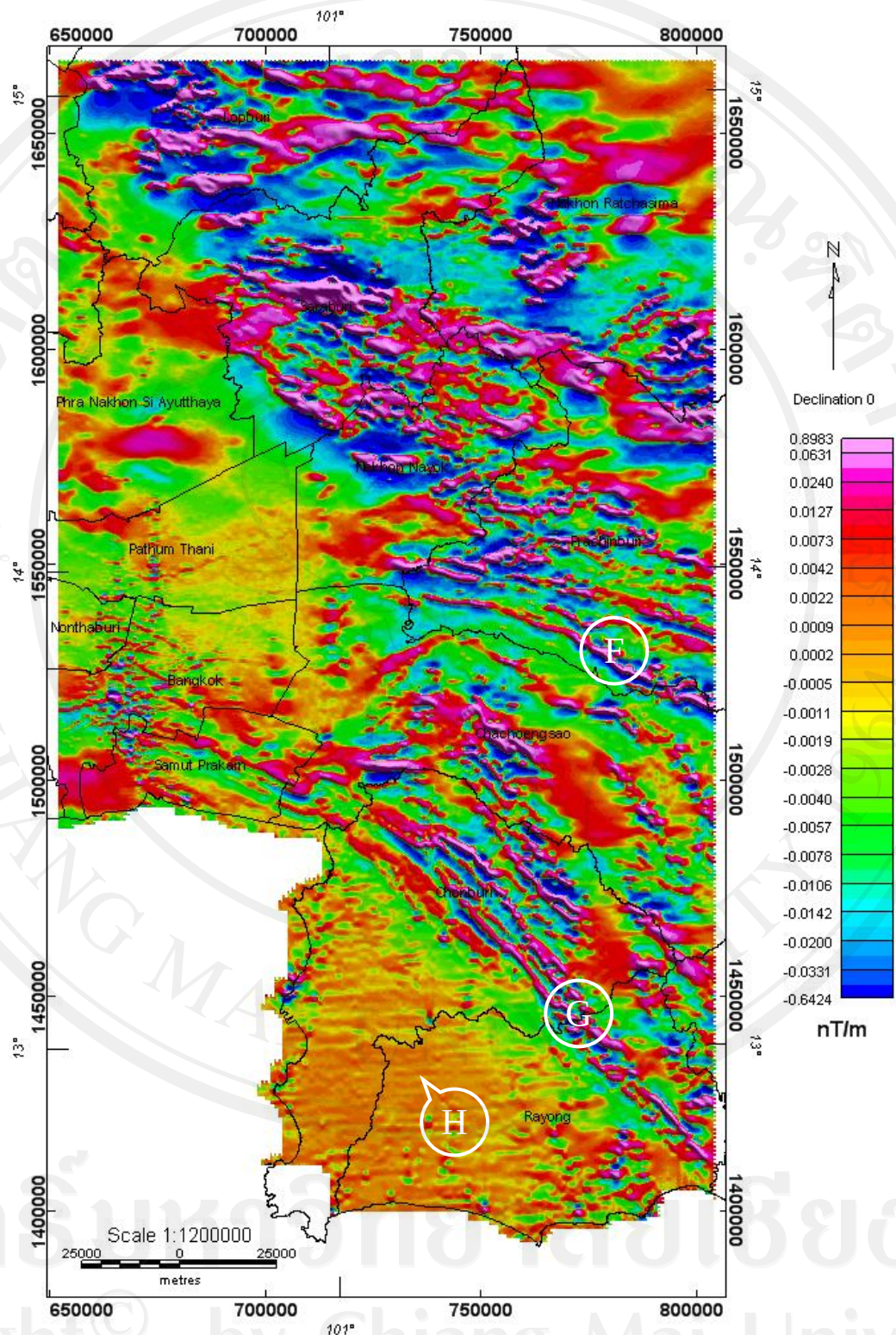


Figure 4.8 First order vertical derivative of the RTP grid in Figure 4.6. The letter “F” and “G” indicate the probable fault anomalies having been enhanced. The letter “H” indicates the line-related noise along E-W direction.

Figure 4.9 Total horizontal derivative of the RTP grid in Figure 4.6. The letter “F” and “G” indicate the probable fault anomalies having been enhanced. The letter “H” indicates the line-related noise along E-W direction. The letter “I” indicates the anomaly probably relating to the artificial objects.

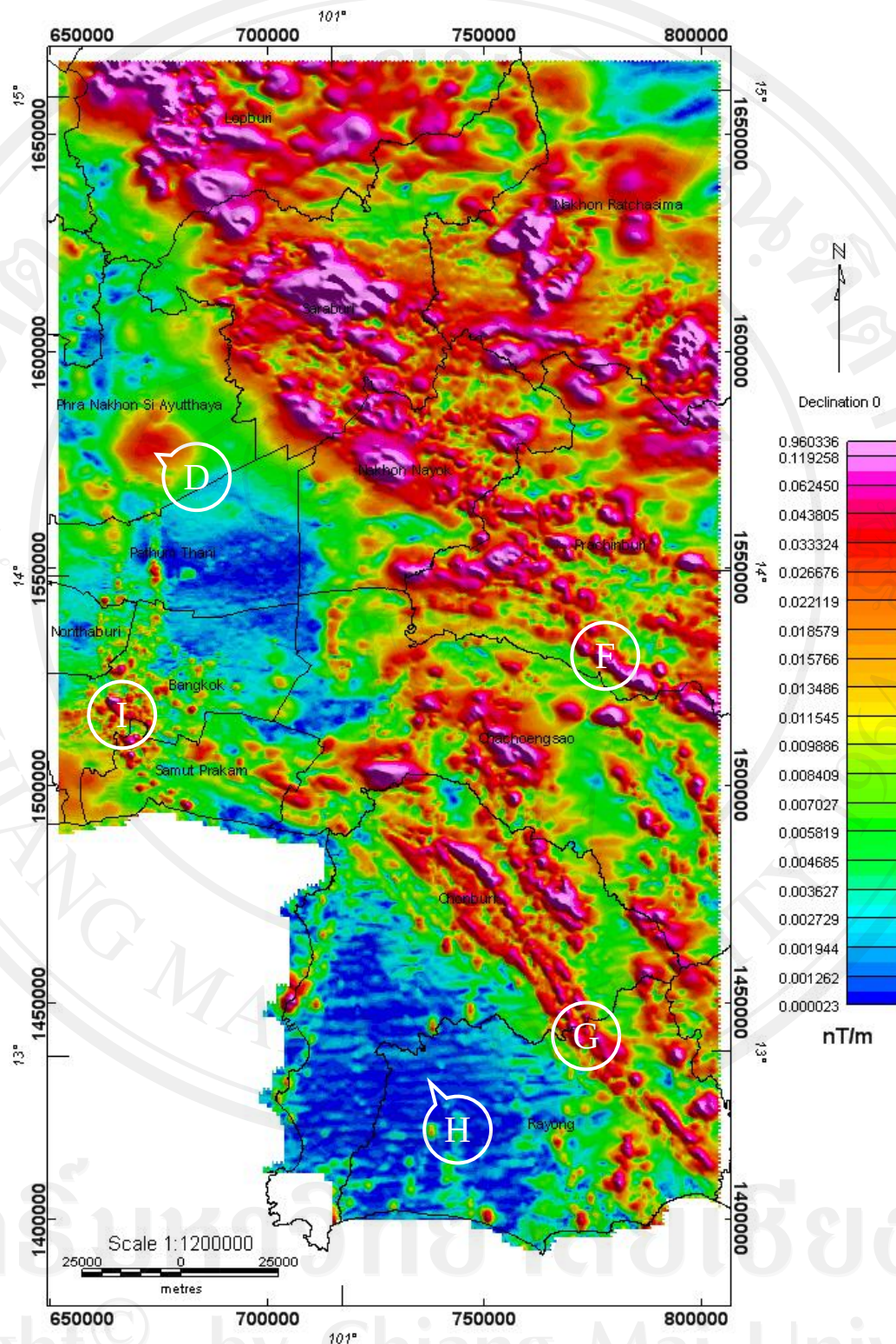


Figure 4.10 Analytic signal of the RTP grid in Figure 4.6. The letter “D” indicates the considered volcanic unit. The letter “F” and “G” indicate the probable fault anomalies. The letter “H” indicates the line-related noise along E-W direction. The letter “I” indicates the anomaly probably relating to the artificial objects.

4.1.5 Qualitative interpretation

An upward continuation was applied to the RTP map (Figure 4.6) to eliminate an effect of shallow sources in the study area. The distance to upward continue was set to be 700 m. Consequently, a sensor was removed to 1 km MTC. The distance corresponds to an attenuation of the shallow source and noise components between wavenumber 0.7 and 1.0 /Km. The upward continuation map shown in Figure 4.11 reveals the much smoother magnetic data. It reveals the attenuation of the short-wave length anomalies and lineaments of main magnetic anomalies. For example, the anomaly “I” is decreased, but the anomaly “C” remains in this map compared to the RTP map. The upward continuation map was used as a guide for making a qualitative interpretation map.

The qualitative interpretation map overlying on the upward continuation map is shown in Figure 4.12. The zones of magnetic anomalies were drawn based on the enhanced magnetic maps that have been created and their similarity of magnetic characteristics such as relief, wavelength and symmetry. The red solid lines indicate certain boundaries. The dashed lines representing an interpreted fault were drawn based on an evidence of a magnetic discontinuity. The magnetic anomalies were grouped into three most important characteristics: strong amplitude, moderate to high amplitude and strong relief and high amplitude anomalies. Obviously, the predominant magnetic units are the zones of strong amplitude anomaly. M1 and M2 represent the areas of low and high magnetic background respectively.

Two fault systems trending NW-SE and NE-SW were regarded to be main fault systems. The NW-SE trending faults occur in both the strong and the moderate

to high amplitude zones. This fault system was regarded as the primary activity. The NE-SW trending faults in strong amplitude zone were regarded as the secondary activity that cut the primary fault system. The rounded magnetic anomaly in Pha Nakhon Si Ayutthaya reflects an igneous intrusive body that has moderate magnetic property. The strong relief and high magnetic amplitude anomalies probably indicate the mafic volcanic units in the area. The surface geologic constraint shows that the strong relief anomalies in Saraburi and Nakhon Nayok result from a Permo-Triassic igneous rock. The high magnetic background M2 in the southern area may be caused by an igneous intrusive body located in Chonburi and Rayong.

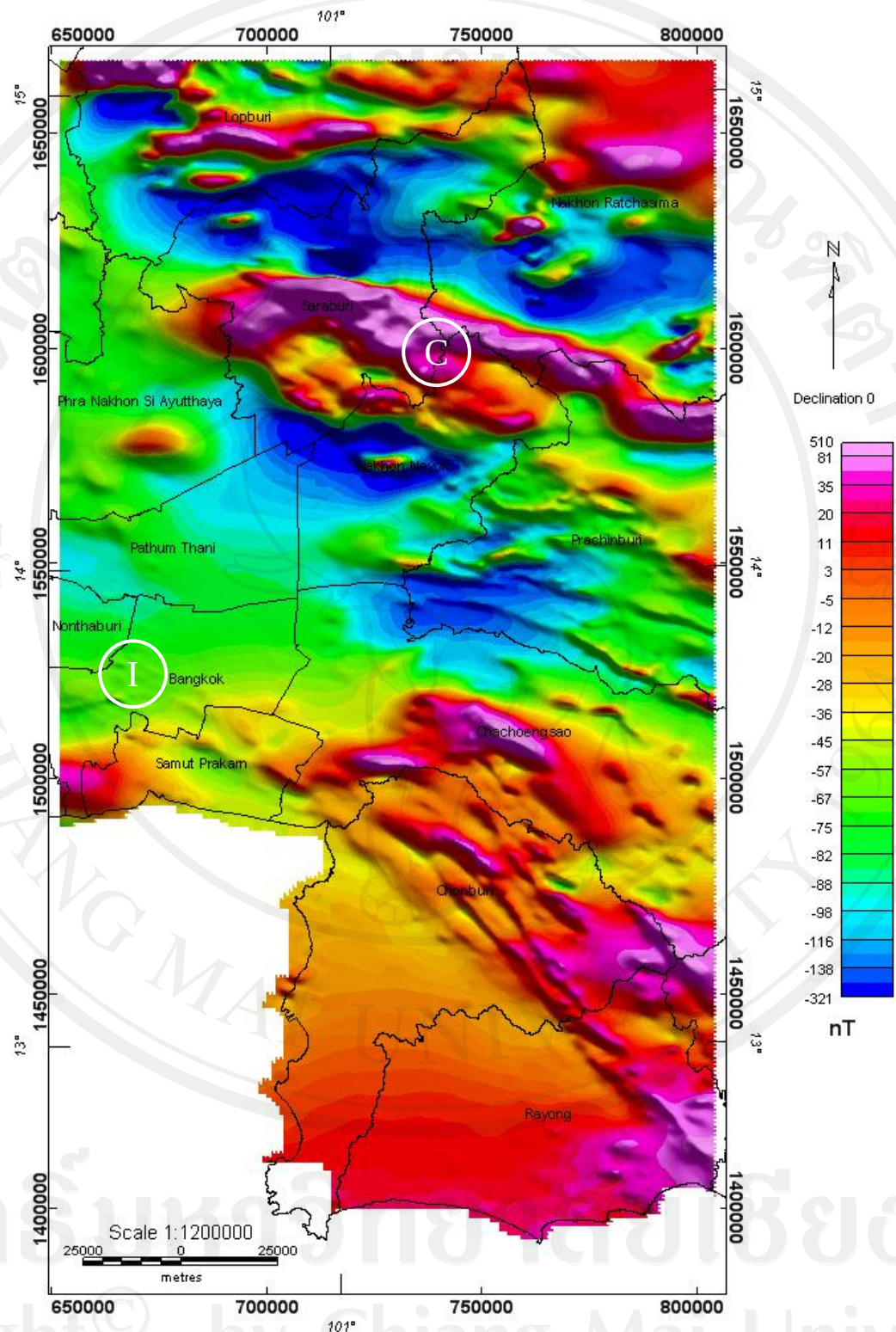


Figure 4.11 Result of upward continuation filter of the RTP grid in Figure 4.6. The continuation distance was set to be 700 m. The letter “C” indicates the smoother anomaly compared to that in the RTP map. The letter “I” indicates the anomaly having been filtered.

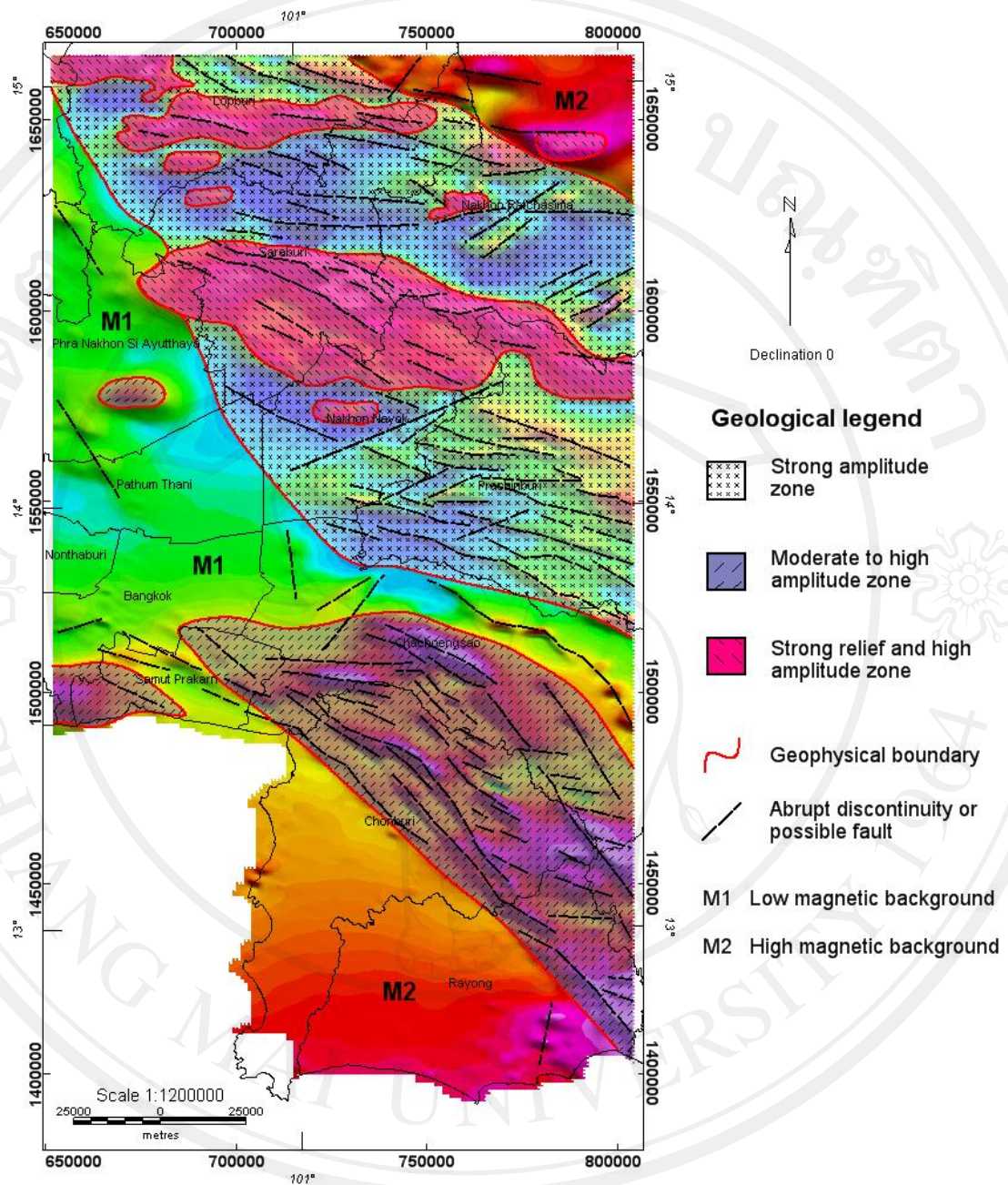


Figure 4.12 Qualitative interpretation map of the aeromagnetic data. The qualitative interpretation map is superimposed on the map of the upward continuation filter in Figure 4.11.

4.2 Gravity data analysis

In this study, the gravity data obtained from the Department of Mineral Resources (DMR) include Bouguer gravity values of the Lower Central Plain, the northeast of the Lower Central Plain (in Lopburi and Saraburi) and eastern Thailand (Chachoengsao, Chonburi and Rayong). The gravity data were collected during the years 2002 and 2003 for the Lower Central Plains and the years 2008 and 2009 for the other areas. Unfortunately, because there is no reference gravity value which is usually used to link the data together, the gravity data were separately examined. Due to the limited gravity data, it was only used to support the main magnetic data interpretation. This study used RANGRID algorithm to grid the gravity survey data with a grid cell size of 1,000 m. The RANGRID has been suggested to be used when the data are collected at random locations as this study is (Geosoft Inc., 2007). A spacing of gravity survey point was approximately 2 km. The Euler deconvolution was individually applied to the complete Bouguer gravity maps in each area to estimate positions and depths of gravity anomalies.

In order to get the complete Bouguer gravity maps corrected an effect of irregular terrain in a vicinity of observation point, a terrain correction was calculated using a normal gradient (-0.3086 mGal/m) for Free-air correction with earth density of 2.67 g/cm^3 for a flat slab correction (Geosoft Inc., 2007).

A digital elevation model (DEM) of the study area with a resolution of $90 \times 90 \text{ m}$ is shown in Figure 4.13. It was downloaded from the USGS website, the Shuttle Radar Topography Mission 3 (SRTM3) of the United States Geological Survey (USGS, 2000) and used to create the regional correction and local DEM grids.

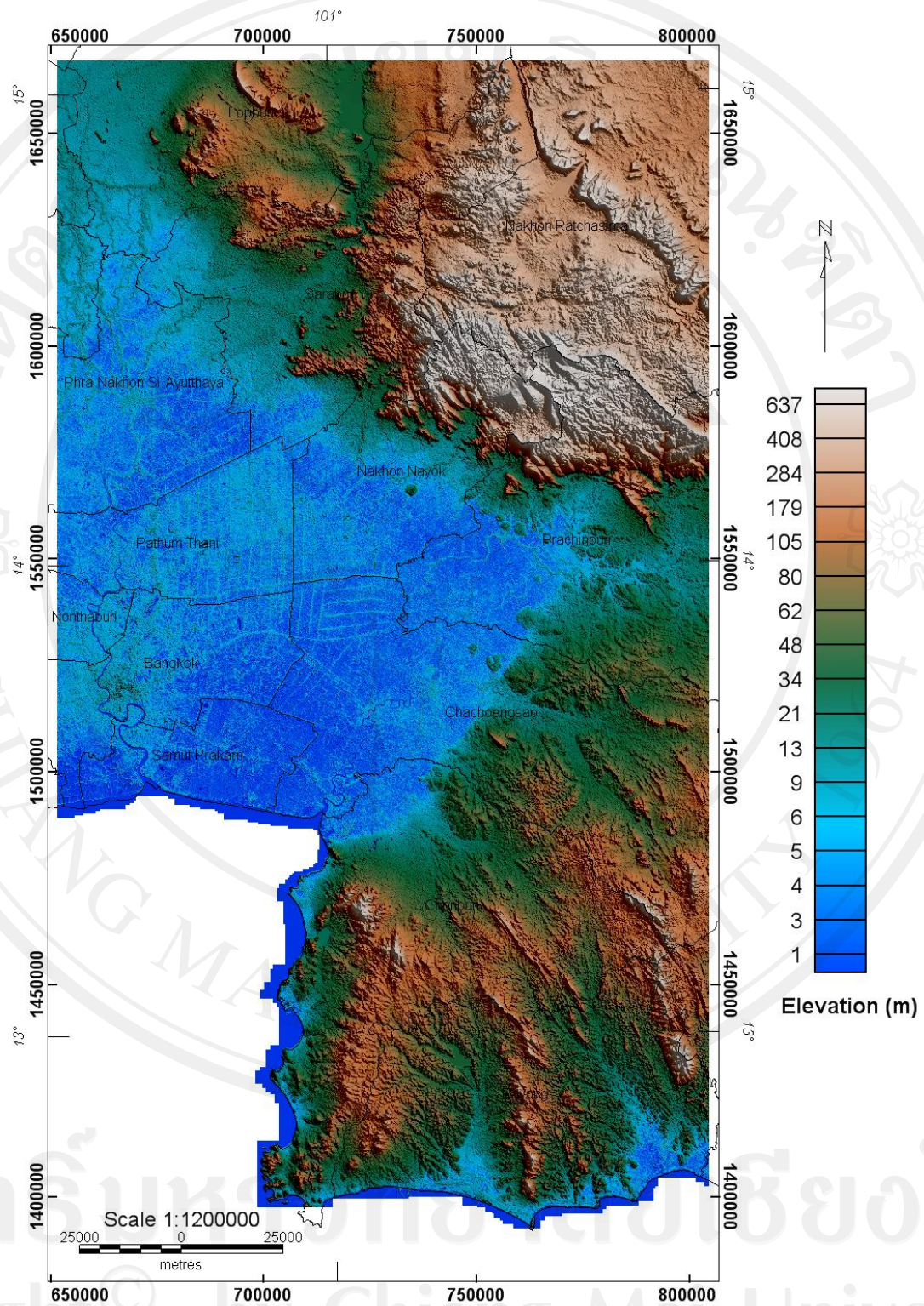


Figure 4.13 Digital elevation model (DEM) of the study area (United States Geological Survey, 2000).

4.2.1 Gravity data

Figure 4.14 is the Bouguer gravity map of the lower central Thailand. The polygonal line outlines the boundary of area used in this study. The dots are locations of the observed gravity stations. The complete Bouguer gravity map of the eastern part of the Lower Central Plains is shown in Figure 4.15. The complete Bouguer gravity values in Figure 4.15 range from -46.48 to 12.70 mGal. The complete Bouguer anomaly lineament is dominated by the high anomaly indicated by “N”. It extends northwestward into Saraburi and reflects the high-density basement in the area. The complete Bouguer anomaly “L” gradually decreases towards the northeast. The round complete Bouguer anomaly indicated by “M” in Phra Nakhon Si Ayutthaya closely corresponds to the high magnetic anomaly “D” in the RTP map (Figure 4.6). The low complete Bouguer anomaly “K” in Phra Nakhon Si Ayutthaya was interpreted to be the Ayutthaya Basin that is bounded by a normal fault along its northeastern margin. The low complete Bouguer anomaly indicated by “O” in the southeast of Nanthaburi was interpreted to be the basin that is cut by a shallow basement feature across Pathum Thani, Bangkok and Samut Prakarn.

Figure 4.16 is the complete Bouguer gravity map of the study area in Lopburi and Saraburi. The range of the complete Bouguer gravity values is -44.96 to -2.36 mGal. There are three distinct areas of a high complete Bouguer anomaly that possibly relate to a high-density basement. It is likely that the high complete Bouguer anomaly indicated by “P” connects to the high complete Bouguer anomaly in the Lower Central Plains (Figure 4.15). The low complete Bouguer anomaly indicated by “Q” in this area may be caused mainly by exposed sedimentary rocks.

Figure 4.17 is the complete Bouguer gravity map of the study area in eastern Thailand. The range of complete Bouguer gravity value is -53.28 to 1.90 . The high complete Bouguer anomaly indicated by “R” trends NW-SE and closely corresponds with the high magnetic feature “G” in the RTP map (Figure 4.6). It extends from the Lower Central Plains through the northwestern-most corner and crosses over this area. According to the available geological data in Chapter 2, the low complete Bouguer anomaly in the southern part is located over the Triassic S-type granite body. A discontinuation of a complete Bouguer anomaly indicated by “S” reveals the NW-SE trending possible fault crossing Chonburi with NW-SE trend. It appears to run towards the Gulf of Thailand passing right through Rayong in N-S direction.

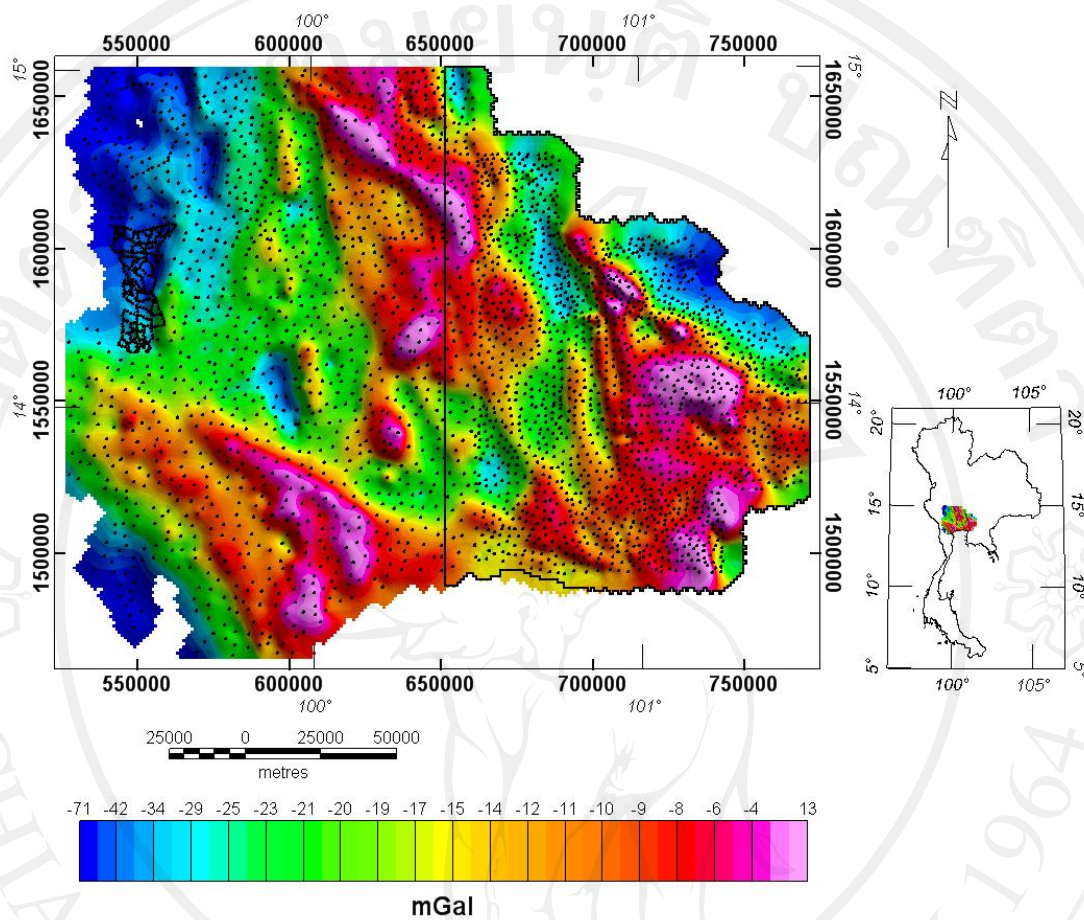


Figure 4.14 Bouguer gravity map of the Lower Central Plain. The study area is outlined by a black polygon. The locations of the observed gravity stations are displayed with the black dot.

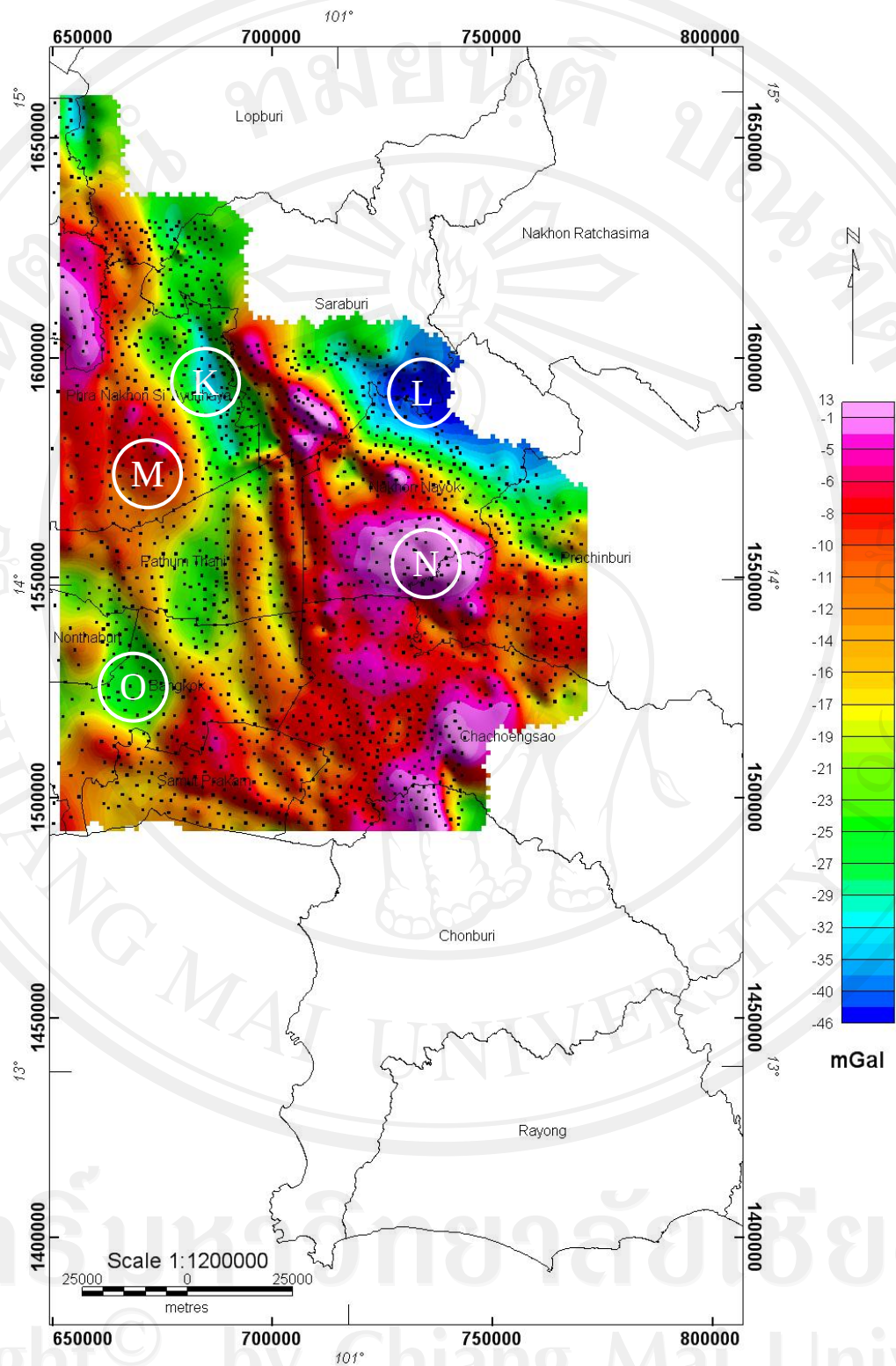


Figure 4.15 Complete Bouguer gravity map of the eastern part of the Lower Central Plains in Figure 4.14. The grid cell size used in gridding is 1,000 m. The letter “L”, “M” and “N” indicate the significant Bouguer anomalies in the area. The letter “K” and “O” indicate the basin areas.

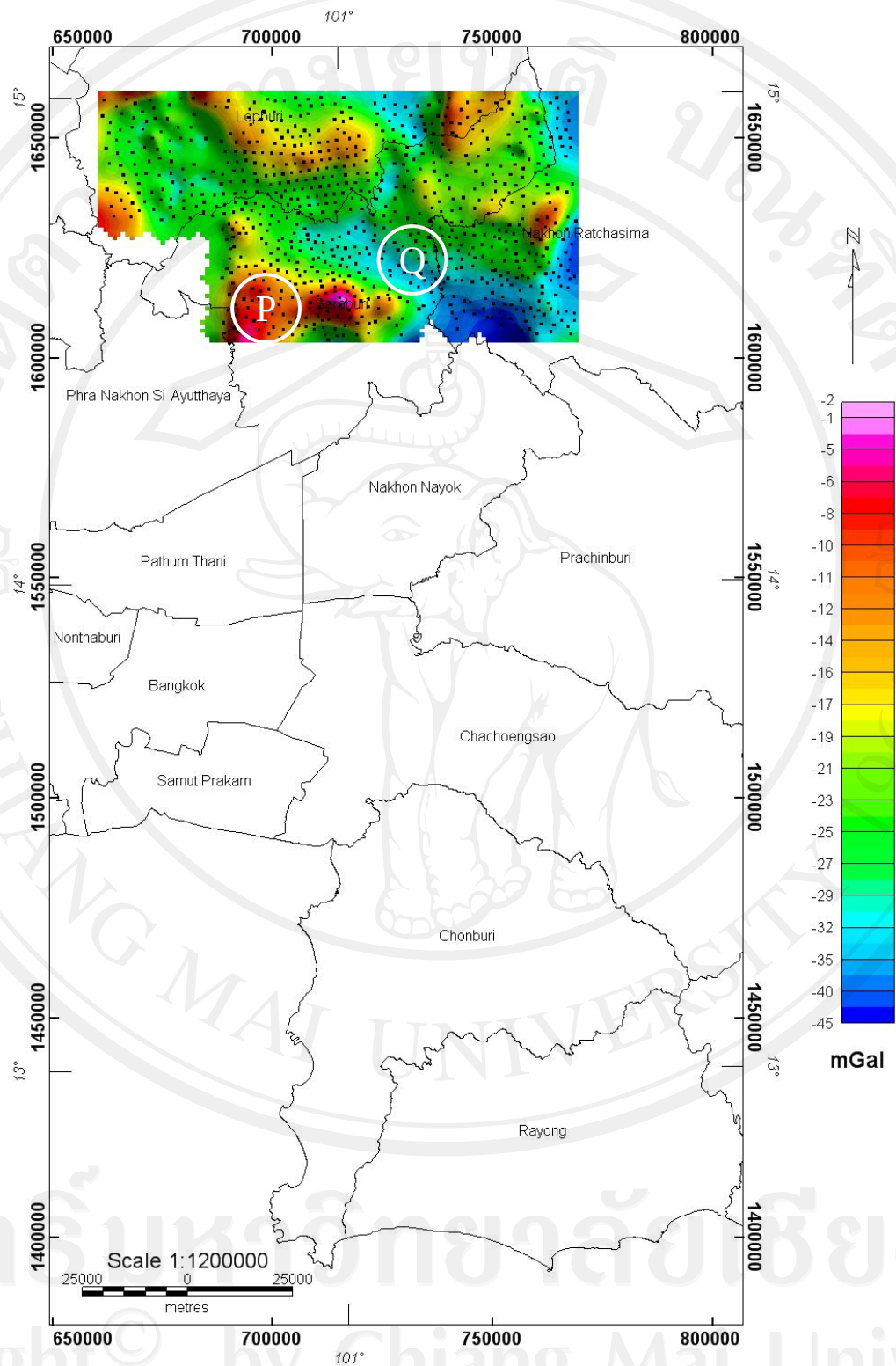


Figure 4.16 Complete Bouguer gravity map of the study area in Lopburi and Saraburi. The grid cell size used in gridding is 1,000 m. The letter “P” indicates the Bouguer anomaly connecting to the high anomaly in the Lower Central Plains. The letter “Q” indicates the Bouguer anomaly relating to the exposed sedimentary rocks.

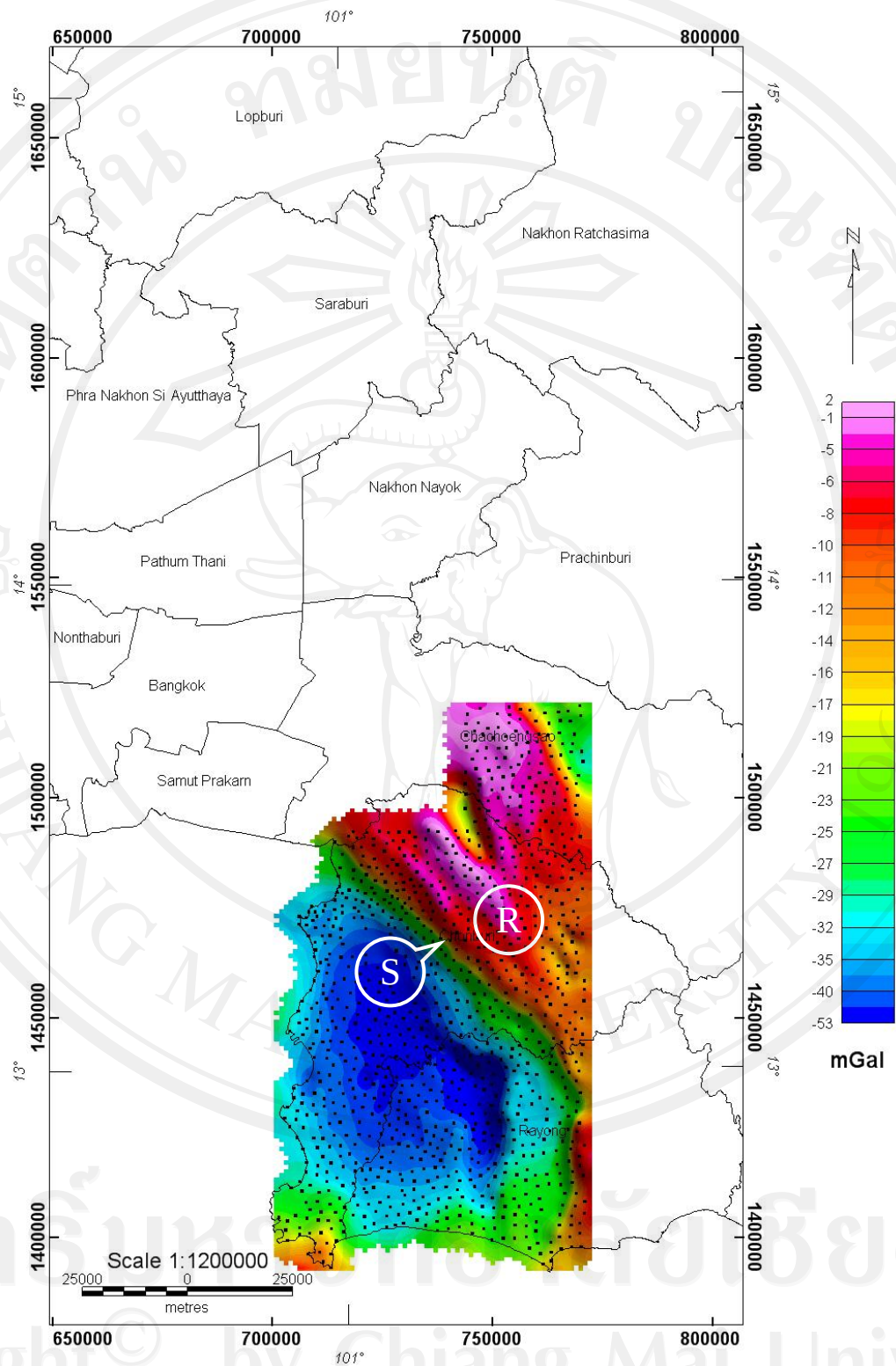


Figure 4.17 Complete Bouguer gravity map of the study area in the Eastern Thailand. The grid cell size used in gridding is 1,000 m. The letter “R” indicates the Bouguer anomaly corresponding to the fault zone. The letter “S” indicates the main fault anomaly.

4.2.2 Spectral analysis of gravity data

Radially averaged spectrum graphs of these gravity data sets are shown in Figure 4.18 to Figure 4.20. All gravity data sets were gridded with the grid cell size of 1 km. A limited Nyquist wavenumber in wavenumber domain is 0.5 /km. According to the radially average spectrum graphs of the eastern part of the Lower Central Plains (Figure 4.18) and the study area in eastern Thailand (Figure 4.20), deepest source components of these areas are about 13.4 km and 13.2 km respectively. The radially average spectrum graph of the complete Bouguer gravity map of the study area in Lopburi and Saraburi (Figure 4.19) shows that a deepest source component is about 7.6 km.

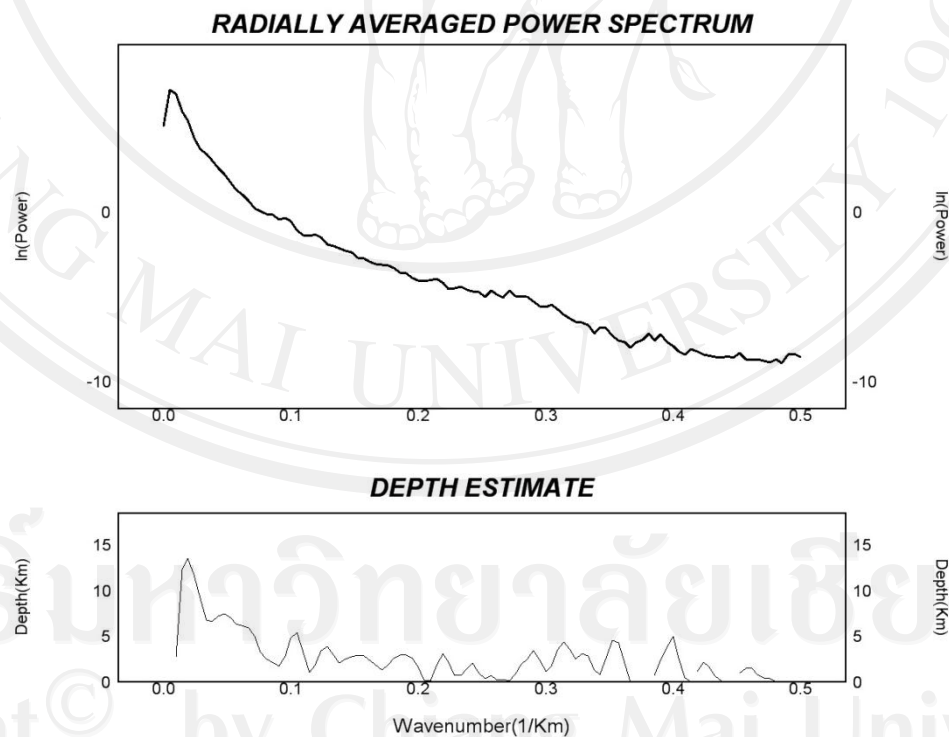


Figure 4.18 Graph of radially averaged spectrum of the gravity data set in the eastern part of the Lower Central Plains (Figure 4.15).

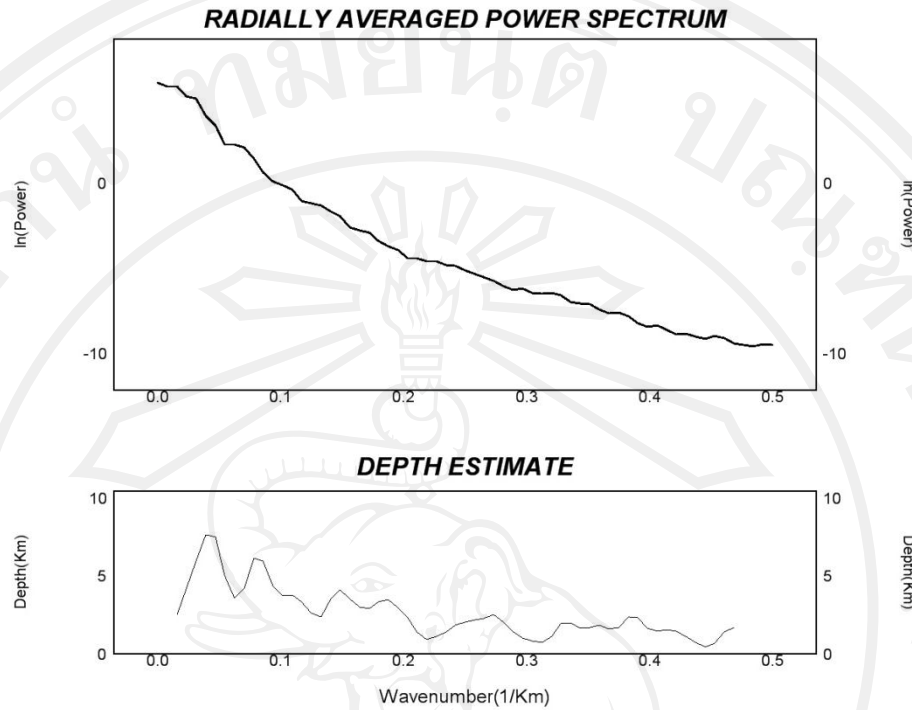


Figure 4.19 Graph of radially averaged spectrum of the gravity data set in Lopburi and Saraburi (Figure 4.16).

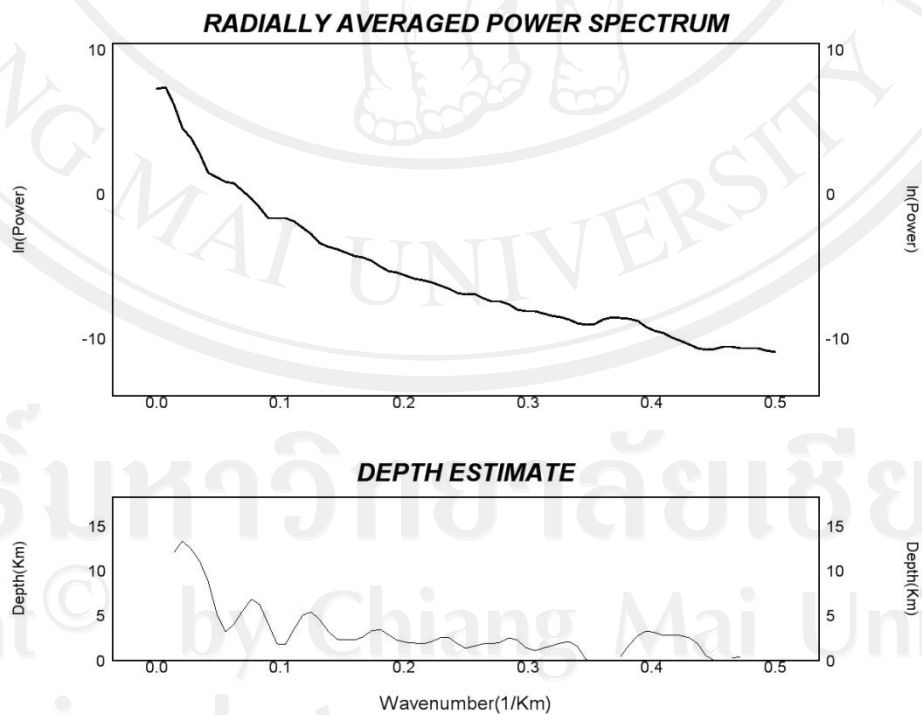


Figure 4.20 Graph of radially averaged spectrum of the gravity data set in the Eastern Thailand (Figure 4.17).

4.3 Euler deconvolution

The 3-D Euler deconvolution discussed in chapter 3 was applied to the aeromagnetic data in order to get a quantitative support such as approximate position and depth of source anomaly. Different window sizes and structural indices were tested for comparison, and more results are shown in Appendix A for aeromagnetic data and Appendix B for gravity data. A parameter selection is based on a cluster of solutions and a reliable condition. The acceptable window size that includes a sufficient variation of field but excludes an effect of neighboring source field was selected. The structural indices followed the values recommended in Table 3.1.

4.3.1 Euler deconvolution of magnetic data

The Euler solutions derived from different structural indices (SI) are shown for determining which parameters give a best result. The different window sizes used were 5×5 , 10×10 and 15×15 . Each window size used the different structural indices which were 0.0, 0.5, 1.0 and 2.0. A growth in WS increases the number of the solution in the map. After consideration of the window size, the window size of 10×10 was considered as a suitable window size.

Figure 4.21 to Figure 4.23 are the results obtained from the structural indices of 0.0, 0.5, and 1.0 respectively. The window size of all indices was fixed at 10×10 grids. The result derived from index of 0.0 (Figure 4.21) reveals defocused solutions over the area. In comparison, the result derived from SI of 0.5 (Figure 4.22) reveals more solution clusters than that derived from SI of 0.0. The result derived from SI of 0.5 shows the solution cluster in Phra Nakhon Si Ayutthaya as well as that derived

from SI of 1.0. The result derived from SI 1.0 reveals the fault lineament in Prachinburi, whereas this fault is not clear in that derived from both SI of 0.0 and 0.5. It is likely that the result derived from index of 0.5 is remarkably similar to the result derived from index of 1.0.

Figure 4.24 shows the Euler solutions derived from applying the window size of 10×10 grids with structural index of 1.0 on the RTP grid (Figure 4.6) which has been gridded at 500 m interval. A depth uncertainty of the solution was set to be a maximum of 10 %. The solution is displayed overlay on the 50 percent transparency RTP map. The plotted symbol size is fixed, but the fill color is varied according to the depth of a solution. The solution map reveals NW-SE trending solution clusters indicated by “1” in Chonburi. These solution clusters are oriented along the interpreted faults in Figure 4.12. The solution cluster indicated by “2” in southern Prachinburi is nearly E-W trending and has the estimate depth of 500 m. It represents a magnetic dike anomaly. Few solutions are located in the Lower Central Plain area, while deep solution clusters are widely found in the northern area. Tight solution clusters in Phra Nakhon Si Ayutthaya “3” and in Samut Prakarn “4” probably indicate magnetic features covered by sediment. Figure 4.25 is a histogram of the estimate depth solution in Figure 4.24. The estimate depth values of the solutions are mostly lower than 2 km.

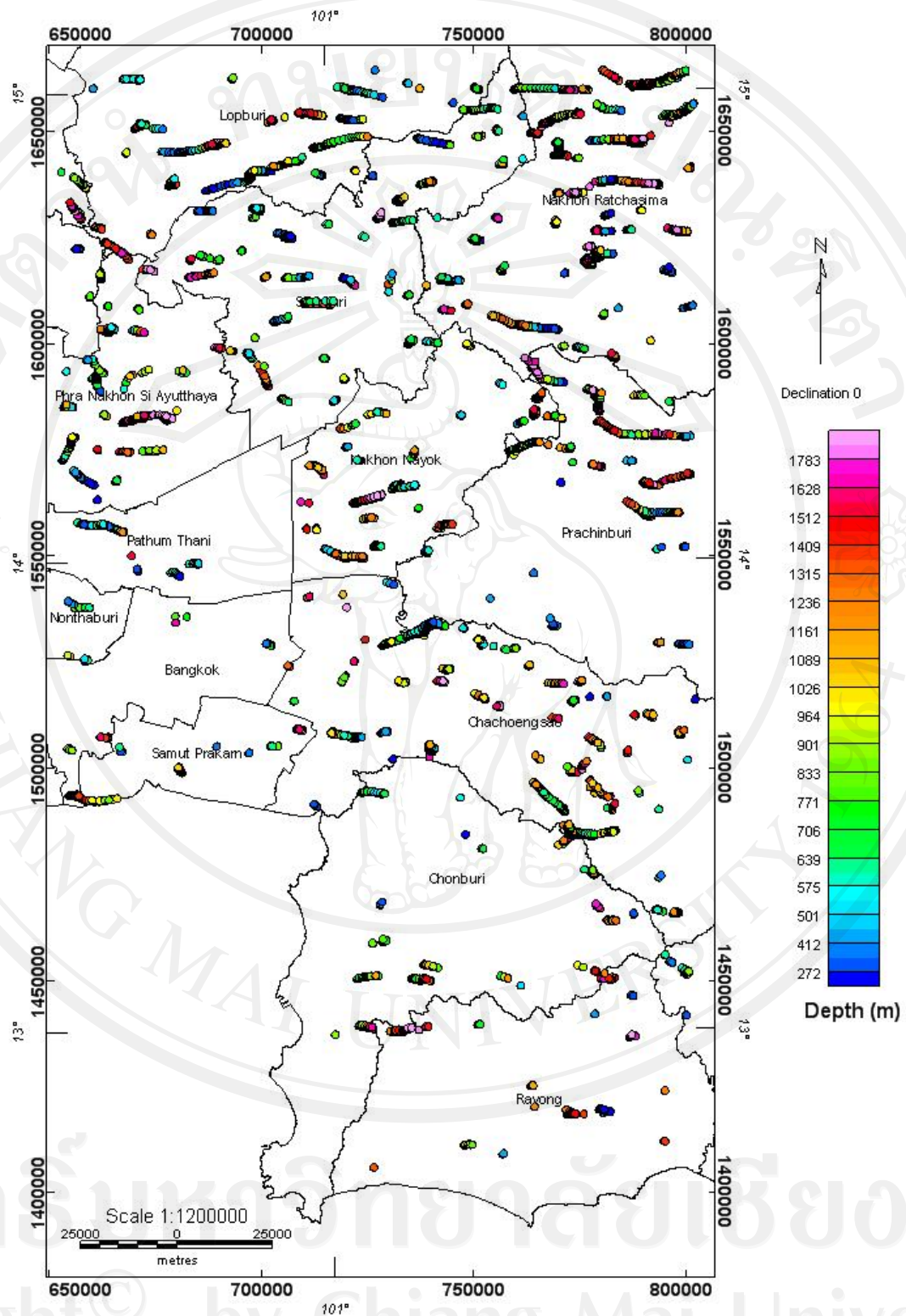


Figure 4.21 Estimate solutions of Euler deconvolution of the RTP grid using 10×10 WS with 0.0 SI. The solutions are represented by a circle symbol plotted with proportional color. The color bar corresponds to the depth scale of the solutions below the surface.

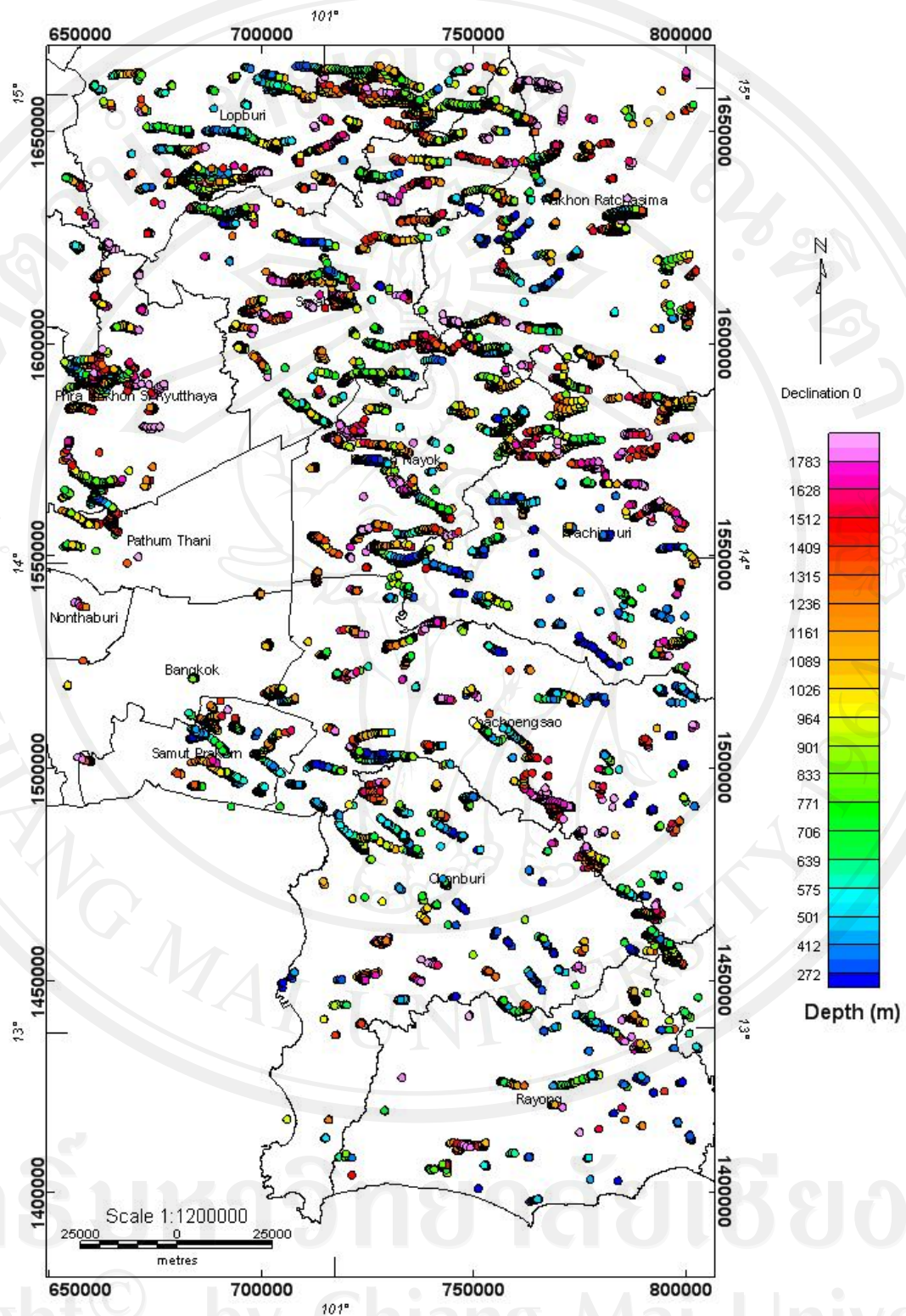


Figure 4.22 Estimate solutions of Euler deconvolution of the RTP grid using 10×10 WS with 0.5 SI. The solution plotting is same as in Figure 4.21.

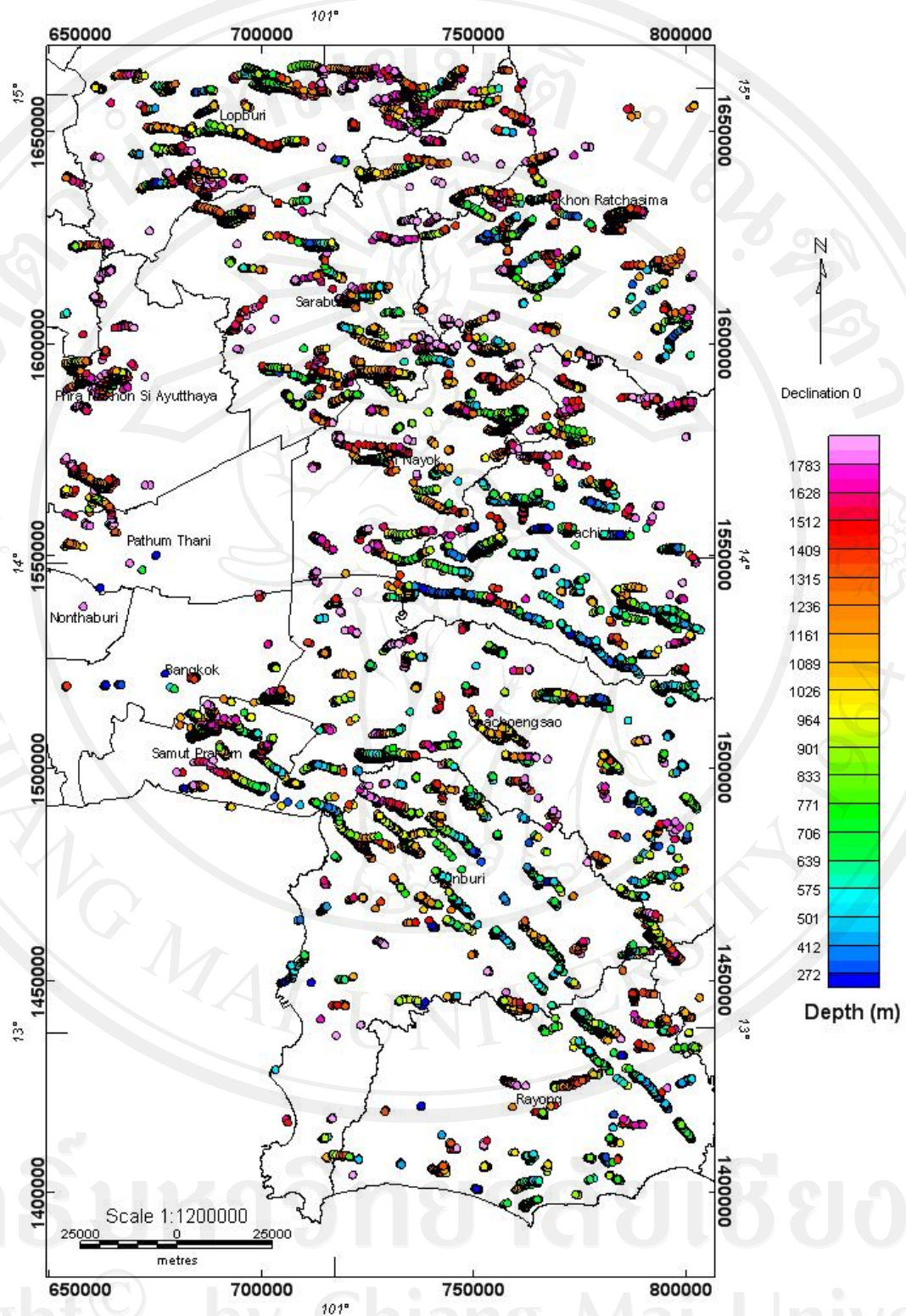


Figure 4.23 Estimate solutions of Euler deconvolution of the RTP grid using 10×10 WS with 1.0 SI. The solution plotting is same as in Figure 4.21.

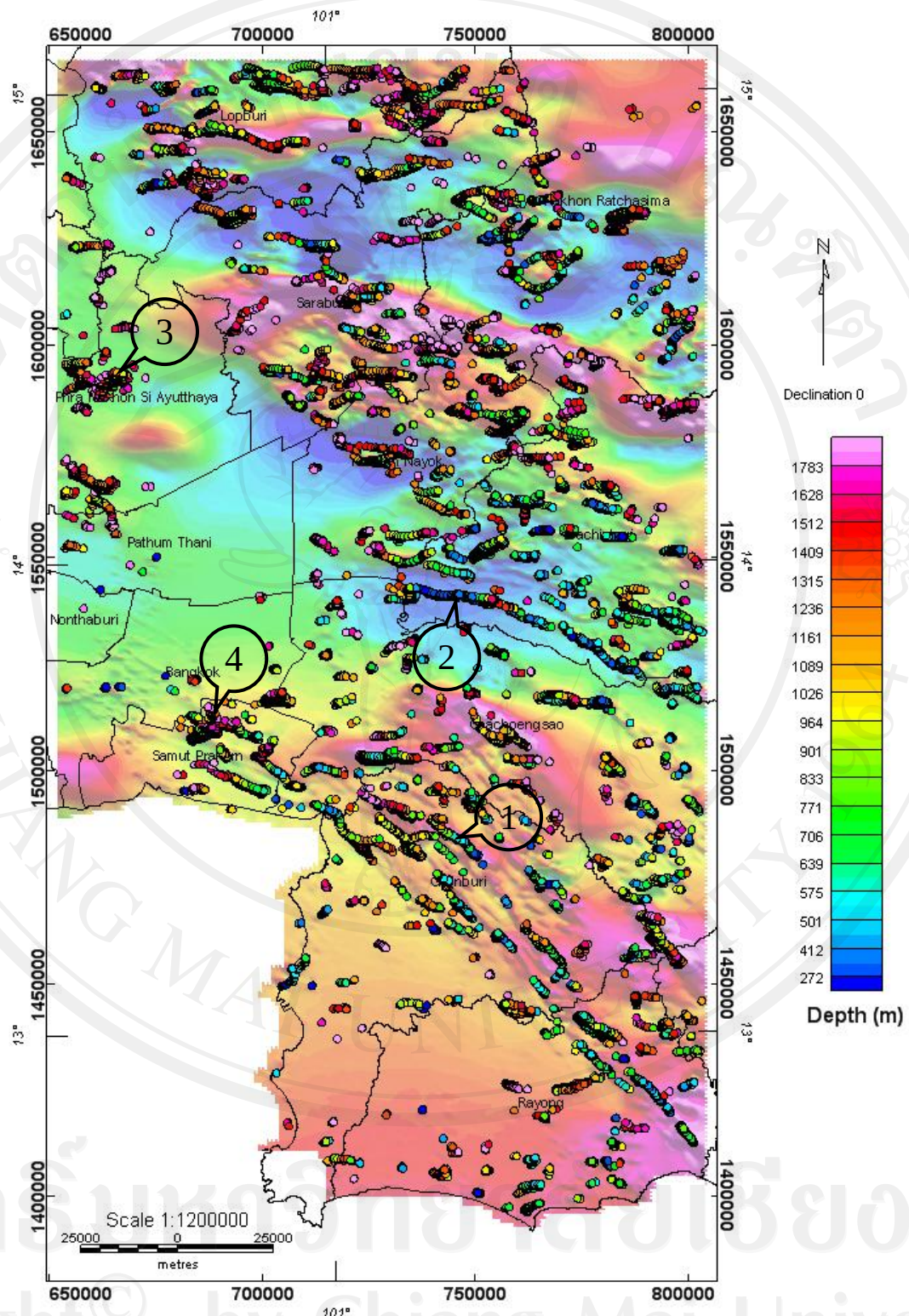


Figure 4.24 Estimate solutions of Euler deconvolution of the RTP grid using 10×10 WS with 1.0 SI. The solutions superimpose on the RTP grid in Figure 4.6. An original color image of RTP grid is shown with 50 percent transparency. The number “1” and “2” indicate the solution clusters representing the interpreted fault and dike structures. The number “3” and “4” indicate the magnetic features covered by sediment.

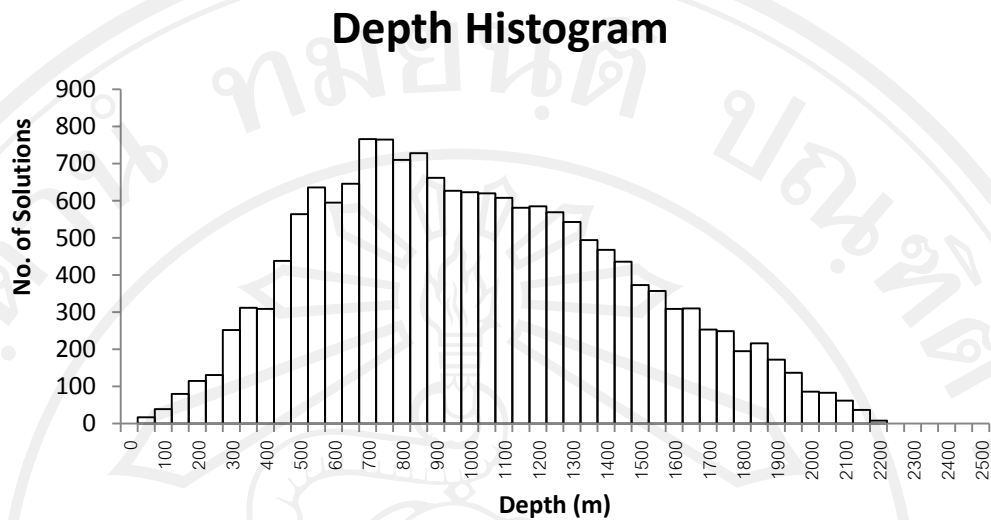


Figure 4.25 Histogram of the estimate solutions in Figure 4.24.

Reid et al. (1990) suggested that the Euler deconvolution is independent of a magnetization direction and a direction of observation. It can be applied to both total magnetic and RTP grids. In this study, the Euler deconvolution was applied to both the total magnetic and RTP grids for a comparison. Figure 4.26 is the solutions that were calculated from the total magnetic grid (Figure 4.1). The WS and SI were 10×10 and 1.0 as the calculation of the RTP grid solutions in Figure 4.24. The result derived from the total magnetic grid cannot show the continuation of the solution cluster in the southern part of Prachinburi, whereas it is recognized in the result calculated from RTP grid (Figure 4.24). By the comparison of these results, the RTP grid gives better focused solutions. Although the solution cluster in Chonburi is well focused in the result calculated from the total magnetic data, this study used the RTP grid to be an input grid in the Euler deconvolution.

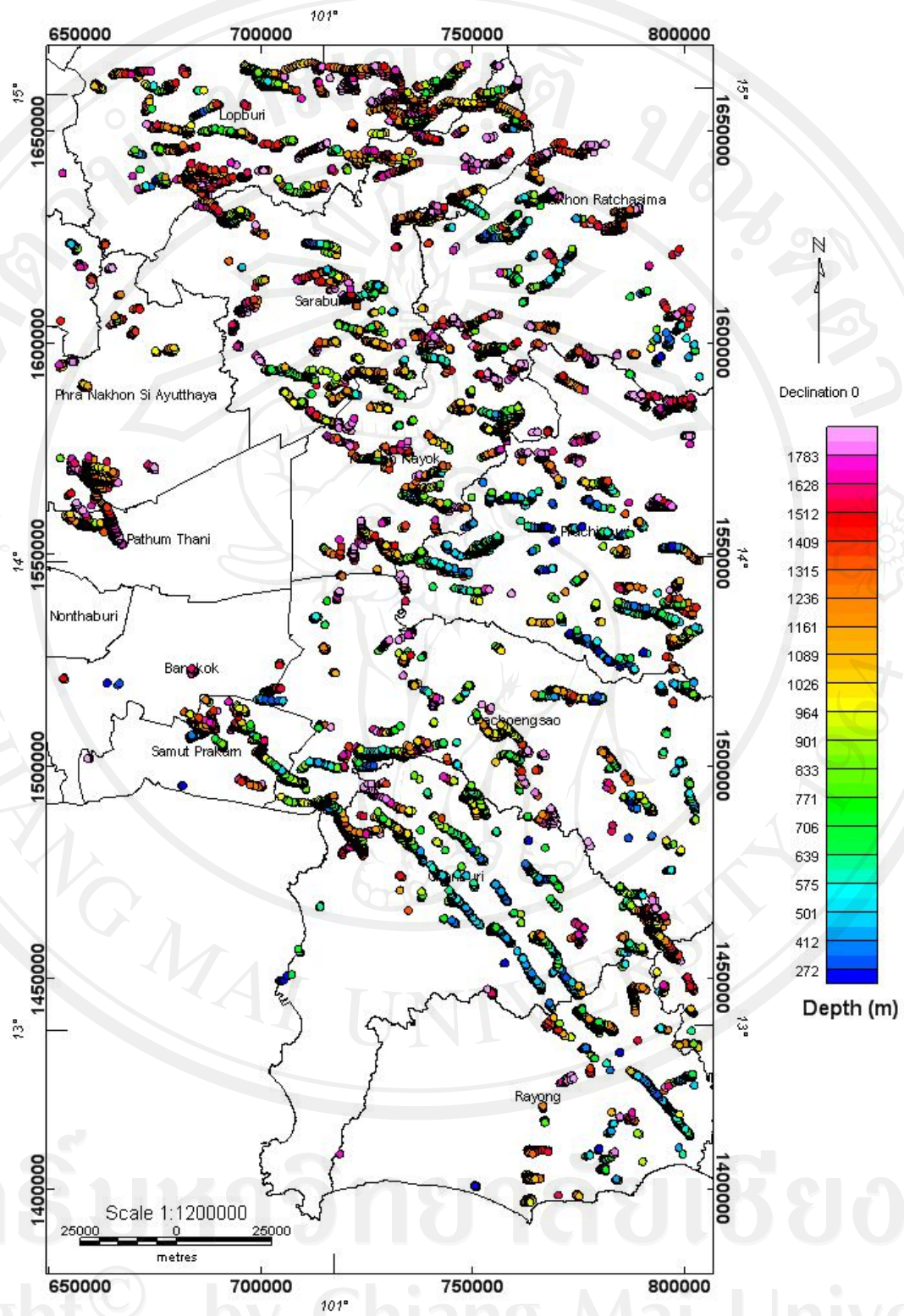


Figure 4.26 Estimate solutions of Euler deconvolution of the total magnetic intensity grid using 10×10 WS with 1.0 SI. The solution plotting is same as in Figure 4.21.

4.3.2 Euler deconvolution of gravity data

The Euler deconvolution was applied to complete Bouguer gravity grids with different window sizes and structural indices to obtain an effective result. The tested window sizes consist of 10×10 and 15×15 , and each window size used the structural indices of 0.0, 0.2, 0.5 and 1.0. The Euler solution maps of the varied parameters are available in Appendix B. The window size of 10×10 grids and index of 0.2 were selected to be the suitable parameters in this study. A depth uncertainty was set to be a maximum of 10%. The input gravity grids were gridded at 1 km. The estimate solutions were merged together after applying the Euler deconvolution individually to each area using the selected parameters.

Figure 4.27 shows the estimate solutions derived from WS of 10×10 grids with SI of 0.2. Estimate solutions are not represented in the eastern part where the gravity survey was not conducted. The bounding fault along the northeastern margin of the Ayutthaya Basin is represented by the solution cluster indicated by “1”. It runs towards Nakhon Nayok in NW-SE direction. The estimate depth of the solution cluster “1” is approximately 2 km. There are two parallel solution clusters indicated by “2” and “3” in Pathum Thani. These solution clusters are N-S trending and have the estimate depth of 1,600 to 1,800 m. The solution cluster that is indicated by “4” shows a boundary of the basin in Bangkok. The estimate depth of this solution cluster “4” is deeper than 2 km. The solution cluster indicated by “5” reveals a boundary of an igneous intrusive body. The calculated depth of this solution cluster “5” is approximately 3 km. The solution cluster “6” reveals a fault lineament trending NW-SE in Chonburi. It likely continues into Rayong in N-S direction. The estimate depth

of the feature “6” is about 4 km in Chonburi and about 2.5 km in Rayong. The solution clusters near the edge of separated areas discontinue from area to area since the Euler deconvolution of these gravity data was separately calculated. Figure 4.28 is a histogram of the estimate depth solutions calculated from the gravity data. The estimate solutions vary in depth from 1 km to 5 km and are very deep by comparison with the result calculated from the aeromagnetic data.

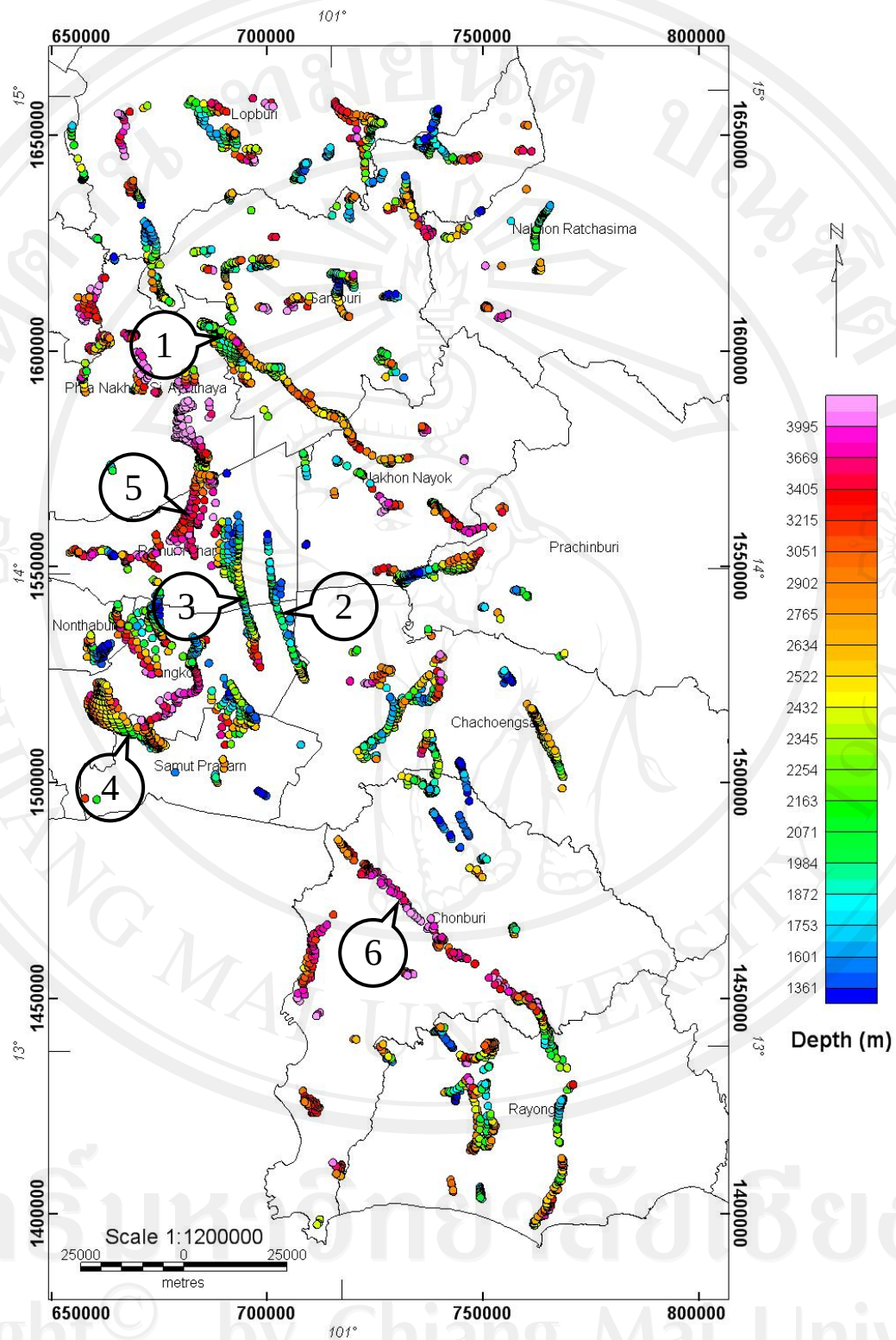


Figure 4.27 Estimate solutions of Euler deconvolution of the complete Bouguer gravity data using 10×10 WS with 0.2 SI. The number “1”, “2”, “3” and “6” indicate the interpreted faults. The number “4” indicates the boundary of the basin. The number “5” indicates the boundary of the igneous intrusive body.

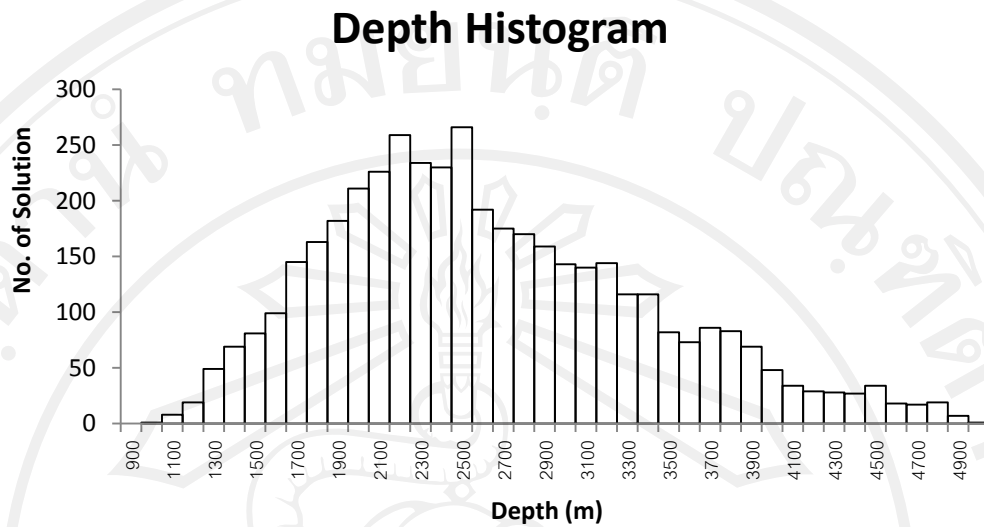


Figure 4.28 Histogram of the estimate solutions in Figure 4.27.

4.4 Integration of aeromagnetic and gravity data

The geophysical data interpretation of the study area was made based on the aeromagnetic and gravity data as well as geological data and available literature. The integrated use of all information enables the interpretation mapping to be reasonable. The interpretation map from this study is shown in Figure 4.29.

The igneous rock units, sedimentary basins and possible faults in the study area were interpreted (Figure 4.29). Major faults in Figure 4.29 were identified as the Mae Ping and Three Pagodas Faults based on available literature (Morley, 2002, Ridd and Morley, 2011). Mafic intrusions are distributed in the northern area, and a predominant pattern of the interpreted faults is NW-SE trending. The mafic intrusions indicated by “1” to “3” may relate to the Eastern Granite Belt (Charusiri, 1993) or to Chanthaburi Terrane (Sone and Metcalfe, 2008). Sone and Metcalfe (2008) defined the Chanthaburi Terrane as the southern extension of the Sukhothai Terrane which

was originally formed as a part of the island-arc system. The major fault “4” was interpreted to be the Mae Ping Fault. The Mae Ping Fault bends towards Prachinburi and continues in an easterly direction (Morley, 2002). The WNW-ESE trending fault zone “5” in Prachinburi stops by Nakhon Nayok. The depth to the anomaly sources of a strand in this fault zone is about 500 m according to the deconvolution of the aeromagnetic data. It may be interpreted that this fault zone causes the high gravity anomaly in Nakhon Nayok as seen in Figure 4.15. The fault zone “6” in the west of Samut Prakarn has been interpreted to be the Three Pagodas Fault zone. The fracture zone “7” having high values of both magnetic and gravity was interpreted to be a fault zone in which various strands is present. These various strands are likely splays of the Three Pagodas Fault (Ridd and Morley, 2011). The deconvolution of the aeromagnetic data showed that the depth to the anomaly sources of a strand in the fault zone “7” is approximately 600 m. The fault zone “6” runs into Samut Prakarn and probably connects to the fault zone “7”. The major fault indicated by “8” was also interpreted to be the strand of the Three Pagodas Fault. The Three Pagodas Fault trends NW-SE passing Chonburi and Rayong (Morley, 2002, Ridd and Morley, 2011). The deconvolution of the gravity data showed that the depth to the anomaly sources of the major fault “8” is approximately 4 km in Chonburi. As a result of the gravity data interpretation, the three parallel faults trending N-S and sedimentary basins were delineated in the eastern part of Pathum Thani. The shallow basement and faults trending NW-SE in Bangkok were also interpreted based on the gravity data.

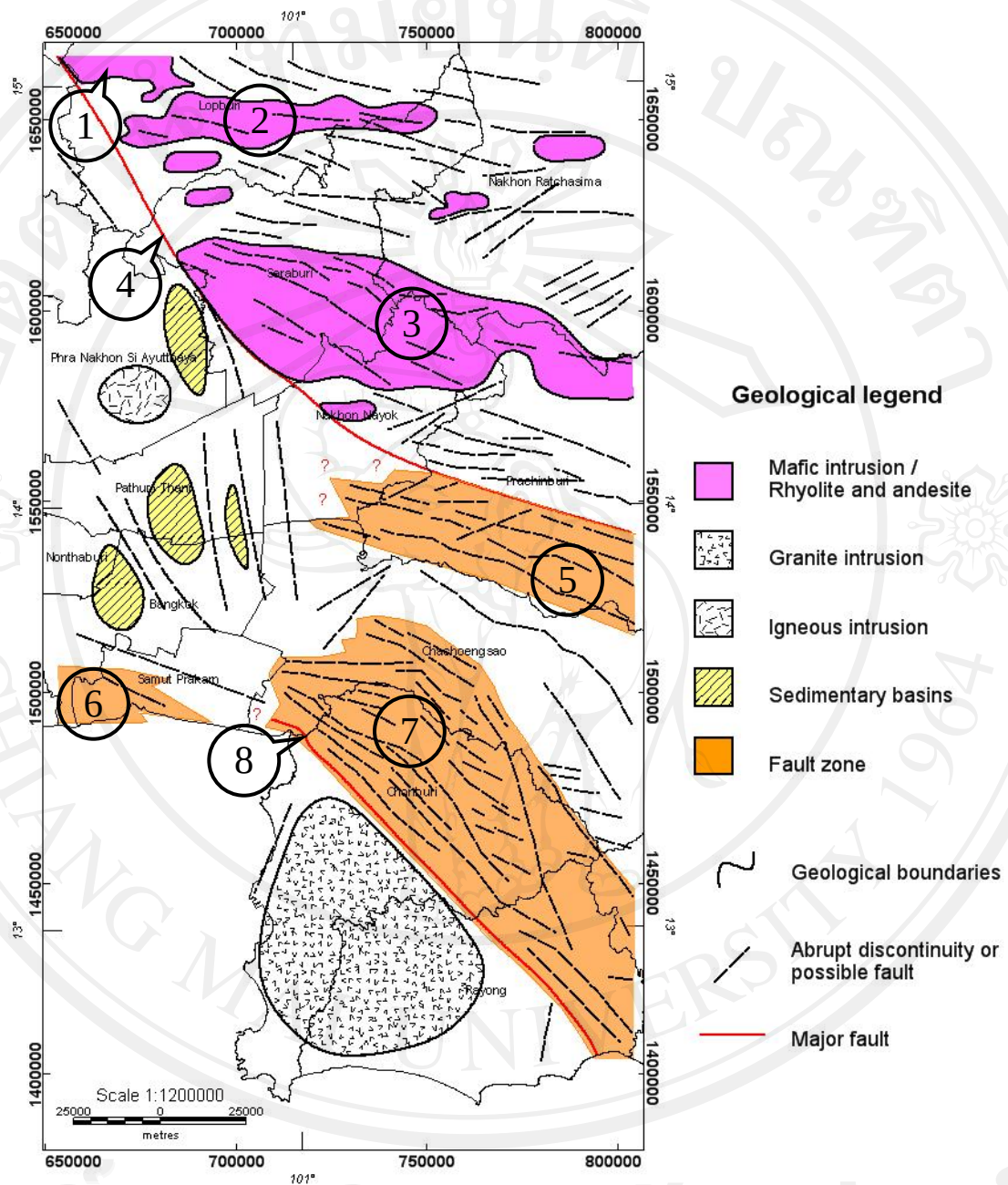


Figure 4.29 Geophysical interpretation map obtained from the integration of the aeromagnetic and gravity data. The number “1”, “2” and “3” are the mafic intrusion features. The number “4” and “8” are the interpreted major faults. The number “5”, “6” and “7” are the interpreted fault zones.