GENERAL GEOLOGY AND GROUND MAGNETIC SURVEYS IN MAMUT COPPER MINE AREA, RANAU

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DECLARATION

This project is at my own initiative except those attached references and other quoted sources.

March 2005

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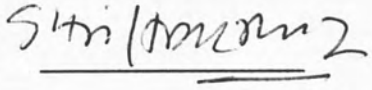

4. DEAN

   (ASSOC. PROF. DR. AMRAN BIN AHMED) _____

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ABSTRACT

The research area is generally focused more on the Mamut Copper Mine, Ranau area with a square of 54km^2. The study is to produce the first ground magnetic surveys contour map of the Mamut Copper Mine, where 2 locations have been selected. Location 1 situated at the east of Mamut Copper Mine's pit area while location 2 situated at the south of the pit area. Based on the residual contour map, the type of rocks and minerals can be identified with a reference to the susceptibility value. Apart from that, this study is to produce 3- dimensional image of the source beneath. Based on the 3- dimensional image, the shape of the source beneath can be seen clearly. From the result, the highest anomaly value for location 1 is 185.99nT with a susceptibility of 0.0046, while the lowest anomaly achieved is –17.47nT with a susceptibility of 0.00394. The highest anomaly reading for location 2 is 7991.08nT with a susceptibility of 0.2 and the lowest is –1307.77, with susceptibility of –0.03. Based on the susceptibility values, the writer made an asssumption that at location 1, there are rocks beneath such as basalt, granulite, rhyolite and gabbro, and minerals such as quartz, chromite, pyrrohotite and pyrite. While at location 2, there are minerals such as magnetite, chromite and pyrrotite, and also magnetization rocks such as serpentinite and adamellite.

ABSTRAK

Kawasan kajian tertumpu kepada kawasan Lombong Tembaga Mamut, Ranau dengan berkeluasan 54km^2. Penyelidikan ini merangkumi aspek geologi am dan geofizik iaitu survei kemagnetan dasar. Kajian ini turut menghasilkan peta kontur survei kemagnetan dasar di 2 lokasi terpilih dengan menggunakan magnetometer. Lokasi 1 terletak pada bahagian timur lombong Mamut dan lokasi 2 terletak pada bahagian selatan lombong Mamut. Melalui peta kontur survei kemagnetan dasar tersebut, interpretasi dilakukan dalam menentukan sebarang kemungkinan jenis batuan atau mineral yang terdapat di dasar melalui nilai kerentanan yang diperolehi. Kajian ini menghasikan imej 3- dimensi bagi struktur dasar. Melalui imej 3- dimensi ini, bentuk sumber magnetik di dasar dapat diperolehi dengan jelas. Melalui data yang diperolehi, didapati bahawa nilai anomali tertinggi yang dicatat pada lokasi 1 adalah 185.99nT dengan nilai kerentanan sebanyak 0.0046. Manakala nilai anomali terendah yang dicatatkan pada lokasi 1 adalah –157.47nT dengan nilai kerentanan sebanyak 0.00394. Bacaan anomali tertinggi pada lokasi 2 pula ialah 7991.08nT dengan nilai kerentanan sebanyak 0.2 dan bacaan anomali terendah pula ialah –1307.77, dengan nilai kerentanan sebanyak –0.03. Berdasarkan nilai kerentanan yang diperolehi, diandaikan bahawa batuan yang berkemungkinan terdapat pada lokasi 1 adalah seperti basalt, granulit, rhyolit, ataupun gabbro. Manakala jenis mineral yang terdapat pada lokasi 1 ialah kuartza, kromit, pyrrohotit serta pirit. Manakala di lokasi 2 pula, bacaan anomali yang tinggi menunjukkan bahawa di dasarnya terdapat mineral seperti magnetit, kromit serta pyrrotit dan juga batuan bermagnetik seperti serpentin dan adamellit.

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CHAPTER 1

INTRODUCTION

1.1 Objectives

The main purpose of this project is to fulfil the requirement of the final year coursework in geology and to expose the writer to actual research writing. The study or research of the project is under one of the main branch of geology studies that is geophysics. Geophysics is the application of the principles of physics to the study of the earth.

The aims of the study are:

a) To explore the general geology and geophysical aspects.

b) To produce the residual contour map and 3- dimensional image of the source.

c) To interpret types of igneous rocks and ore deposits that situated around the study area based on the magnetic anomaly readings and the magnetic susceptibility values.

1.2 Location of the Study Area

Sabah covers an area of about 73,997 square kilometres, border the territory of Indonesia's Kalimantan and Ranau covers 3.8% of Sabah. The study area, former Mamut Copper Mine, is located in the Northwest of Sabah, about 68 km east of Kota Kinabalu (Figure 1.1), where the altitude is between 1200m and 1500m above the sea level. The mine is about 121 km Northeast of Kota Kinabalu and it takes about 2 $^{1}/_{2}$ hours drive to the mine. The Mamut area is situated on the South - eastern slopes of Mount Kinabalu (4,101 m high) and the nearest town is Ranau- 12 km by road.

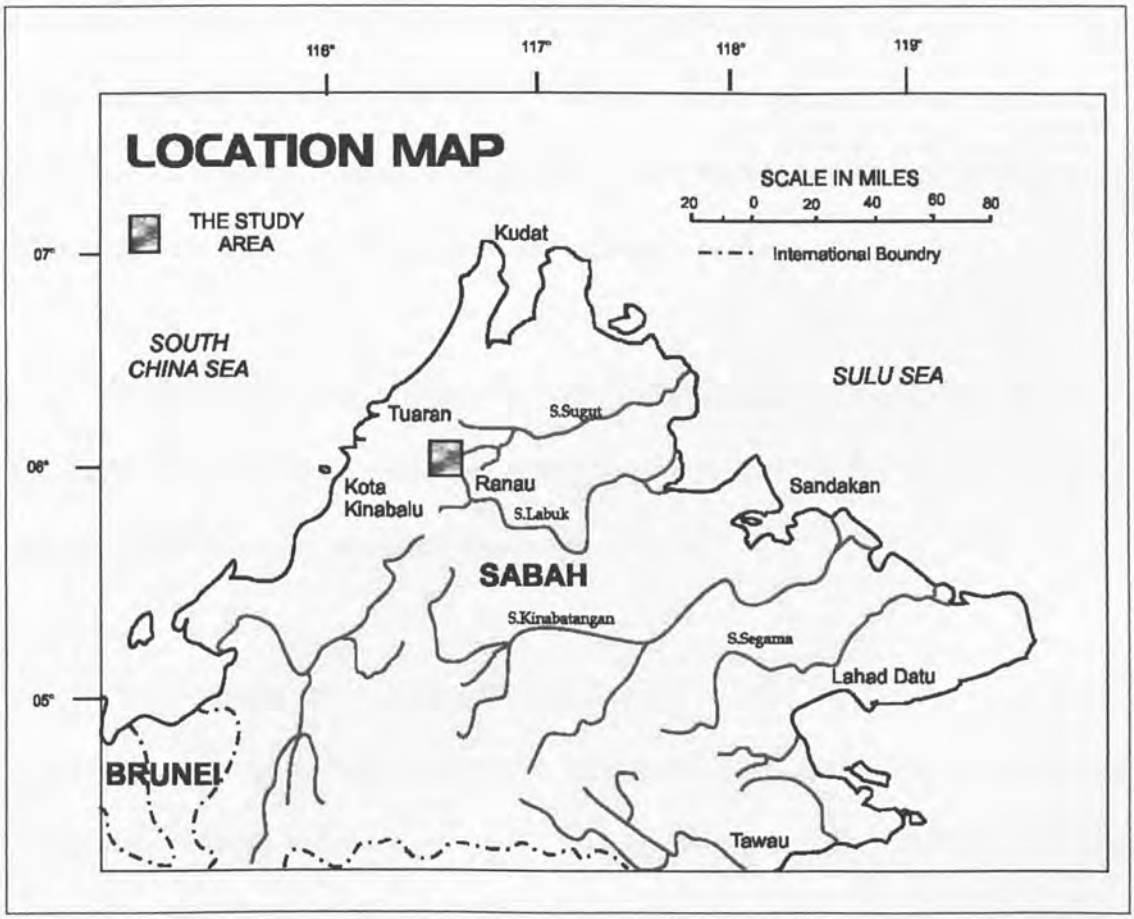

Figure 1.1 Location map of the study area.

1.3 Methodology

In making the studies to be more effective, the writer decided to take an alternative to divide methodology of research into five phases. The phases are compiled systematically with order and they are literature review, fieldwork and sampling, laboratory work, data analysis and interpretation, and writing of the report.

1.3.1 Review of Literature

The first thing of the scientific study involved a detailed review of literature and study of as existing data and field trips to study area. Before the site preparation is under taken, review of literatures was initially done to collect published and unpublished data such as Memoir, Journal, Annual Conversion Report of Geological Society of Malaysia, previous theses and other related reference books.

This process is needed to give general background of the study field and forms the background knowledge on the inherent characteristic of the study area. Data obtained is to be used in later analytical study.

Aerial photographic (series number: SA 0072 L37W 10- SA 0072 L37W 14) and topographic map is studied to identify the structural, geomorphologic features and photo lineaments of the study area such as faults and thus aid in understanding the regional tectonic of the study area, which have a bearing on the geological conditions. Confirmation of the interpretation from the desk study is then conducted during the field trip.

The study of the topography map is to determine the pattern of the drainage system. It also studies the direction of runoff pattern, which flow in the differences of terrain in the study area.

1.3.2 Fieldwork and Sampling

Geological mapping was conducted to determine and delineate the local geology within the study area. The types of geological structures were determined. This will help to understanding the geology of the study area and its effect to the study area. Outcrops were determined and dip and strike of joints, faults and beddings were also taken. Figure 1.2 shows the base map of the study area where the sampling, fieldwork and magnetic surveys are done.

1.3.3 Laboratory Work

Laboratory work is a method that involves the writer in doing lab - work. One of the lab - works that is done by the writer is the preparation of thin sections. Thin sections are needed in the research, as they are useful for identifying the petrography of rocks that found in the study area.

1.3.4 Data Analysis and Interpretation

This phase is to analyze and interpret all the collected data from the field in order to study the geophysics properties and its geological aspects. Field interpretation of magnetic data allows areas needing infill or checking to be identified and then

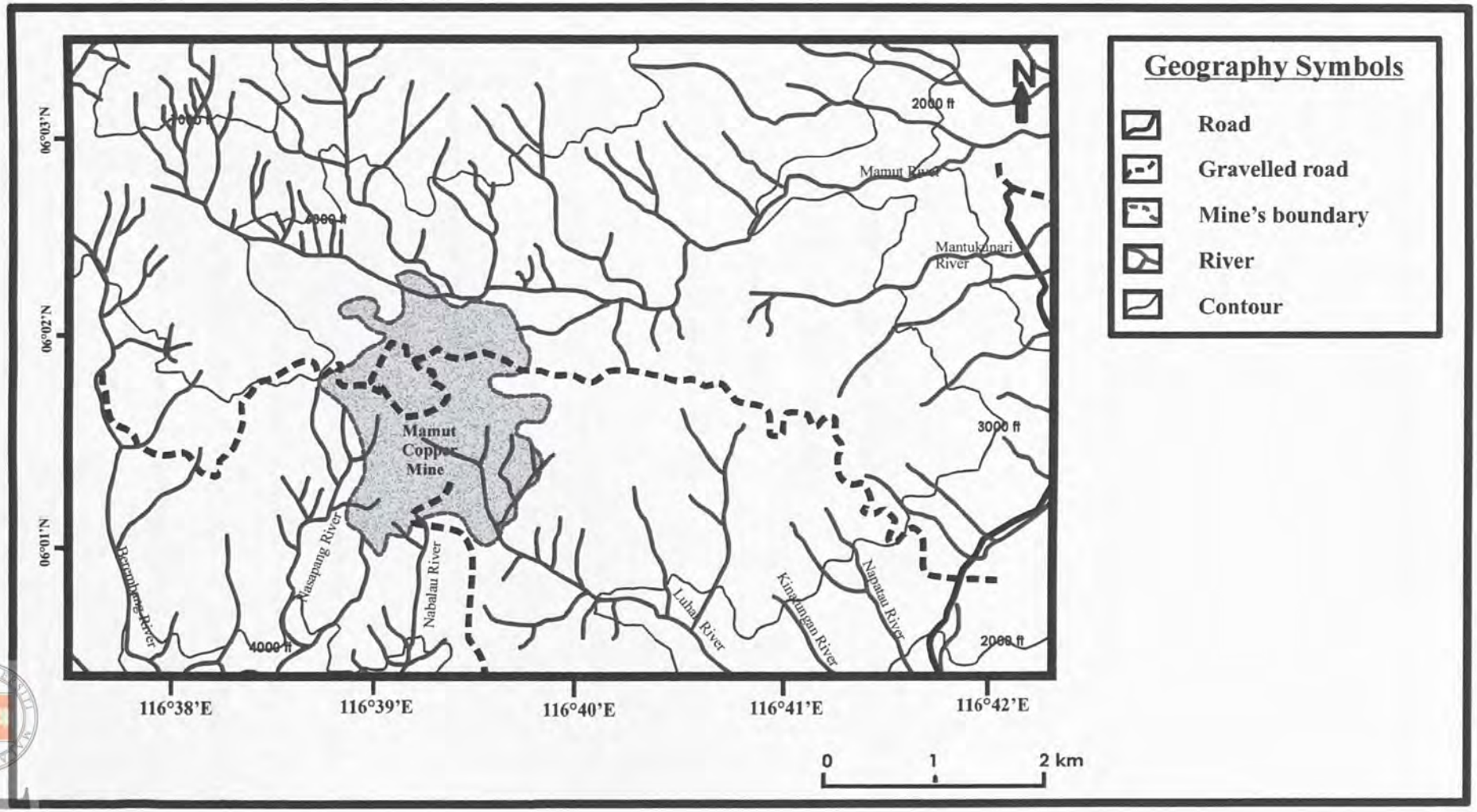

Figure 1.2 Base map of the study area (54km^2).

revisited immediately at a little cost. Good interpretation requires profiles, which preserve all the detail of the original readings, and contour maps, which allow trends and patterns to be identified.

1.3.5 Writing of the Report

The achievements of the writer's research will be written in a report after all the data and information is gathered and compiled. This report consists of various chapters:

Chapter 1: Introduction

Chapter 2: Geography and geomorphology

Chapter 3: General geology and stratigraphy

Chapter 4: Ground magnetic surveys

Chapter 5: Conclusion and recommendation

1.4 Previous Studies

1.4.1 Previous Study of the Ranau Area

Posewitz (1892) was the earliest geologist to attempt stratigraphy for British Borneo. He considered that the mountain formation formed Gunung Kinabalu and the area surrounding it. In his geological map of the Colony of British Borneo (1892), he considered the Ranau area as Post- Tertiary alluvium (Siong, 1974).

Niethammer and Hotz (1915) geologists of the Royal Dutch Shell group mapped the sedimentary rocks of the Kinabalu area as the Eocene Formation (nowadays called the Crocker Formation) and the Old Slate Formation (nowadays called the Trusmadi Formation) and the squeezed strata (Ida, 1982).

The only comprehensive account of the geology of the area is Collenette (1954), which carried out a geological reconnaissance study in the Kinabalu area. Collenette (1954) regarded the Crocker Formation as the Crocker Range type sediments. Collenette also introduced the term Trusmadi Formation for rocks in the Trusmadi Mountains and this is characterized by a predominance of argillaceous rock, siltstone, mudstone, and subphyllites with occasional tuff. No particular type section has been designated. Collenette (1957) introduced the Crocker Formation for the sedimentary rocks of the Crocker Range and defined it as comprising of sandstone (sometimes massive), siltstone, red, grey, green, black mudstone and shale (Meng, 1999).

Collenette, 1958, described a type area in the Jesselton - Kinabalu area for the Crocker Formation. No specific type area was designated. Collenette (1958) described Ranau Plain as made up of two types of alluvial deposit, granodiorite boulders, sand and clay forming a Piedmont fan and finer detritus as forming a flood plain (Collenette, 1958).

In his geological map of the Jesselton - Kinabalu area, colony of North Borneo, the Ranau area it is shown to be made up of sediments of the Crocker Formation, Trusmadi Formation and Quartenary Deposits (alluvium and rock debris

forming a Piedmont fan) and acid igneous intrusions. Age of the Crocker Formation was considered to be from Eocene to Middle Miocene and the age of the Trusmadi Formation was considered to be from Eocene- Lower Miocene. Collenette (1958) mapped the sedimentary rocks immediately surrounding Gunung Kinabalu as Undivided Eocene to Miocene. The occurrence of Miocene sediments are at about two miles southwest of Ranau (Collenette, 1958).

Bowen and Wright, 1958 (in Lietchi *et.al.,* 1960) divided the Crocker Formation into the " East Crocker Formation" and the "West Crocker Formation" on abundance of marls. The East Crocker Formation includes foramineferal shale, which are absent in the West Crocker Formation. The East Crocker Formation, which is supposed to be present in the Ranau area is bounded to the east by the Trusmadi Formation and to the west by the West Crocker Formation. Bowen and Wright mapped the sedimentary rocks facing Gunung Kinabalu as Wariu Formation, including the 'Undivided Eocene to Miocene' of Collenette.

Kirk (1962) obtained a small amount of the heavy minerals, zircon and cinnabar from panning concentrates near the confluence of Sungai Keripir and Sungai Liwagu.

Newton Smith (1967) described parts of the Crocker Formation in the Bidu-Bidu Hills.

Jacobson (1970) described parts of Crocker Formation and Trusmadi Formation of Gunung Kinabalu area. In his geological map of the Gunung Kinabalu

area, Sabah, he mapped the Kundasang Ranau road as made up of the Crocker Formation and he gave a structural sketch along the rock. He also studied the Pinosuk Gravels in detail and considered it to be tilloid deposits (Jacobson, 1970).

Tjia (1974) described the structural trends of the Crocker Formation and the Trusmadi Formation in the Ranau - Tenompok area as being intensively deformed into flasered strata, low - angle reverse to over thrust faults and over turned to recumbent folds. He suggested that the assemblage of rocks is comparable with mélange of subduction zone because of the close association of flasered Trusmadi and Crocker sediments with metabasite in the Wariu Formation and so called "Chert Spilite" formation in the area (Tjia, 1973).

Yokuyama and Yoshidi (1974) gave a regional account of the Crocker Formation in the Kinabalu area. While McManus and Tate (1976) studied volcanic structure of the North and West Borneo and suggested that the Crocker Formation was deposited in a fluvatile environment. This is in sharp contrast with all other geological work in the Crocker Formation (MacManus and Tate, 1976).

Hans and Denis (1993) did the stage model for the tectonic evolution of the NW Sabah continental margin. They divided the NW Sabah continental margin into tectono - stratigraphic provinces on the basis of differences in structural styles and sedimentation histories (Hans and Denis, 1993).

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