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MINERAL LIBERATION STUDIES OF COMPLEX GOLD ORE FROM PERANGGIH PROSPECT, PAHANG

By

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DECLARATION

I hereby declared that I have conducted completed the research work and written dissertation entitled “Mineral Liberation Studies of Complex Gold Ore in Peranggih, Pahang”. I also declared that is has not been previously submitted for the award of any degree or diploma or other similar of this for any other examining body of University.

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ABSTRAK

Prospek Peranggih yang terletak di Timur Laut semasa Lombong Emas Selinsing dimana mineralisasi emas berlaku dalam struktur ricih serantau yang sama yang dengan deposit Selinsing dan Buffalo Reef yang dikaji. Tumpuan kerja penyelidikan ini adalah menumpukan pada pengenalpastian komposisi kandungan mineral dan peratusan pembebasan mineral pada pecahan saiz sampel yang berbeza dari prospek Peranggih. Komposisi mineral dianalisa dengan menggunakan XRF. Penentuan dan pengiraan fasa galian dianalisa dengan menggunakan XRD. Kajian morfologi dari setiap pecahan saiz ditentukan dengan menggunakan mikroskop optik dan SEM. Sebelum analisis XRF dijalankan, analisis LOI dijalankan untuk menyingkirkan fasa yang meruap dalam sampel dan nilai LOI adalah agak rendah iaitu 3.6%. Hasil daripada XRF diperolehi menunjukkan nilai Si adalah tinggi iaitu 31.6% diikuti oleh Al dan Fe masing-masing adalah 10.1% dan 4.2%. Kemudian analisis fasa mineral telah dilakukan yang kandungan mineral silika adalah yang tertinggi di antara mineral logam lain seperti Arsenopyrite (FeAsS), Galena (PbS), dan Hematit (Fe_2O_3) manakala nilai untuk Quartz (SiO2) dan lain-lain adalah kira-kira 84.0%. Dalam kajian morfologi, pemerhatian sampel dan sifat-sifat fizikal lain di bawah “Tabletop SEM” menunjukkan morfologi mineral biasanya dalam bentuk yang tidak tersusun dan berkeping. Untuk kajian pembebasan mineral, pembebasan mineral yang paling tinggi ialah 21.149 % yang berlaku pada pecahan saiz (-0.075) mm. Peratus pembebasan mineral semakin meningkat apabila saiz pecahan semakin berkurangan.

MINERAL LIBERATION STUDY OF COMPLEX GOLD ORE FROM PERANGGIH PROSPECT, PAHANG

ABSTRACT

The Peranggih prospect which is located to the North East of current Selinsing Gold Mine where the mineralization of gold took place within similar regional shearing structure that hosting Selinsing and Buffalo Reef deposits were studied. The focus of this research work is concentrate on identification composition of mineral content and percentage of mineral liberation at different size fraction of the sample from Peranggih sites. The mineral composition is analysed by using XRF. Mineral phase determination and quantification is analysed by using XRD. The morphological study from each size fraction is determined by using optical microscope and SEM. Before XRF analysis is carried out, LOI analysis is conducted as to remove volatile phases in the sample where the value of LOI is quite low which is 3.6%. The result from XRF obtain indicate the value of Si is high which is 31.6% followed by Al and Fe both of them are 10.1% and 4.2% respectively. Then mineral phase analysis has been done which content of silica minerals is the highest among the other metallic mineral such as Arsenopyrite (FeAsS), Galena (PbS), and Hematite (Fe_2O_3) while the value for Quartz and others is about 84.0%. In morphological studies, the observation of sample and other physical properties under Tabletop SEM indicate the morphology of the mineral usually in form of irregular in shape and flaky. For mineral liberation studies, the degree of mineral liberation attain at size fraction of (-0.075) mm is 22.37% of mineral liberation. The percentage of mineral liberation increase as decreasing of the size fraction

Chapter 1

INTRODUCTION

1.1 Significant of Project

Gold is a precious metal that throughout history, almost every culture has use gold to symbolize beauty, power and achievement. It also has been involving in all kind of technologies due to the properties of gold such as conduct electricity, ductility, malleable and others.

. In Malaysia, the development of gold shows that the hydrothermal fluids play important role at the Central Gold Belt which is 20km wide. Mineralization in Central Gold Belt is mainly by gold that is mined from the quartz vein that took place within a low-grade-meta sedimentary-volcanic terrain formed during the collision of Sibumasu block below the East Malaya block through the Permian to late Triassic. (Kamar Shah, 2012).

The Peranggih gold prospect is located to the north of Selinsing which has the same regional shearing structure as the Selinsing and Buffalo Reef gold deposits. At Selinsing, the deposit hosted by a series of auriferous quartz veins and stockworks of quartz veinlets in a package of sheared calcareous epiclastic sediment (Kamar Shah, 2012). In this research work, the gold ore studied is obtained from Peranggih prospect which located in Selinsing Gold Mine Manager Sdn Bhd, Kuala Lipis, Pahang. Figure 1.1 shows the in between Selinsing Gold Mine Manager property which include Peranggih site.

Figure 2.1: Area of Peranggih prospect in Selinsing Gold Mine Manager(Monument Mining, 2018)

However, a details characterization of this type gold ore has not been performed yet. A technique to evaluate and optimize the gold mineralization and recovery process test is a process mineralogy which is receives more attention from both mineralogist and metallurgist. It would be enhancing the gold extraction and this study is often involved in various kind of technologies.

This research works presents a mineralogical characterization study technique using XRF, XRD, optical microscope and SEM-EDX of gold ore from Peranggih prospect, Pahang. Types of gold ore classified based on gold mineralization and style mineral composition and texture. Degree of liberation of gold ore provide essential information for potential of gold ore processing design and planning.

1.2 Objective

1. To characterize Peranggih Gold ore using elemental composition analysis (XRF), mineral phase identification and quantification analysis (XRD) and morphological studies by using optical microscope and scanning electron microscope (SEM) with energy dispersive X-ray (EDX)
2. To identify the associate minerals of Peranggih gold ore.
3. To determine mineral liberation at different size fraction using Image J software.

1.3 Problem Statement

The aim of this project is to characterize Peranggih Gold ore, characteristic, mineralogy and texture of associated with Peranggih gold and determine the rate the liberation at different size fraction by using specific experimental and analytical techniques.

Due to slightly different occurrence of geological structure between Peranggih prospect and Selinsing area, the mineralogy of sulphide gold ore is also different in soil or hard rock in present of gold mineralization. Although the deposit type is mesothermal gold ore deposit and mostly associated with pyrite, arsenopyrite and galena, the variation of mineral composition is vary with different section at Peranggih prospect. The different location of sample collected can cause the variation of mineral composition. This characterization process covers the study of morphological features such as shape, grow patterns, size, the inclusions or heterogeneities within grains, as well as detailed in morphology analyses of previous research.

Most primary sulphide ore bodies have mineral assemblages that are unstable in near-surface conditions. At Peranggih prospect, the assemblage of argililite and limestone is

a dominant structure with 200m wide range, north-south striking shear zone which parallel the tectonic Raub- Bentong suture to the west and within the gold mineralization occurrence which give the different level of oxidize zone within the ore body for North and South region (Naidu, 2005). The presence of numerous sulphide in the ores resulting in difficulty in extraction of gold due to its natural resistant to recovery by standard cyanidation and carbon adsorption. The process of metallurgy require pre-treatment process which is roasting, bio-oxidation, pressure oxidation and albion process.

1.4 Scope of Research

In this research work, a potential gold-bearing rock sample were taken at Peranggih prospect where the location of high potential of gold mineralisation is being studied. The bulk sample with 12 different size fraction and complexity has been studied as a part of research work. The sample were taken by using grab sampling and undergo comminution process such as crushing. In order to obtain the representatives samples, the product from comminution process were split and divided using cone and quartering method as well as Jones Riffle Splitter for further mineralogical study.

The representative's samples were analysed for physical and chemical composition analysis. This include particle size analysis (Malvern), elemental composition analysis (XRF), phase identification and quantification analysis (XRD), and morphological study by using optical microscope, SEM EDX and mineral liberation studied by Image J software.

The representative samples were sieved to below for 12-size fraction has been used for morphological studied. The sizes are (+4.75) mm, (-4.75+3.35) mm, (-3.35+2.36) mm, (-

2.36+1.18) mm, (-1.18+0.6) mm, (-0.6+0.425) mm, (-0.425+0.3) mm, (-0.3+0.212) mm, (-0.212+0.15) mm, (-0.15+0.09) mm, (-0.09+0.075) mm, (-0.075+(-0.075) mm. Each highly expected of gold bearing were examined as to study the level of liberation observation under polarizing ore microscopy and scanning electronic microscopy (SEM) with the help of energy dispersive X-ray (EDX) in order to identify of any presence of gold and other mineral by using semi-quantitative weight percentage.

1.5 Thesis Organization

This thesis be divided into five chapter which are introduction, literature review, methodology, results and discussion and conclusion. The first chapter discuss about the significant of this project, the objective of this project, the problem statement and also the scope of research work. All of these sub topics in the first chapter will provide the information on the purpose and the methodology that has been used in this project.

Next chapter is literature review where all the information about previous work that relevant in this project will be included such as the research background, the mineralogy of the gold, the geological formation of the gold and others. Chapter three will be focus on methodology that been used as to gain the objective in this research work.

The next chapter four where the most crucial section where the result been discussed in this chapter. The data that have been analyzed will be discuss in this chapter. Last but not least, the chapter five highlights on the conclusion made based on the interpretation and discussion of the result including the recommendation and future study.

Chapter 2

LITERATURE REVIEW

2.1 Mineral Identities

Mineral is a naturally occurring inorganic substances that usually crystalline form. Mineral has specified chemical composition as mineral is the aggregate of the element. Mineral can be classified into native elements which are oxides, halides, sulphides, carbonates, phosphate and silicates. Besides, mineral can be classified into two groups which are metallic mineral and non-metallic mineral. Metallic minerals are extracted from mineral deposits which produced by geological process. For example, copper, gold, nickel, lead or zin are metallic mineral that are profitable to mine. Non-metallic mineral are minerals that have no metallic luster and can break easily. For instance, limestone, sand, marble or clay.

2.2 Mineral Liberation

Mineral liberation is the first procedure in order to liberate the metallic mineral from their host rock. The liberation process of mineral often complicated as to ensure the end product of liberation can enhance the processes of extraction. The milling equipment with the perfect parameter needed to be studies as it will affect degree of gold liberation. The valuable minerals is liberated from gangue minerals through reduction of size which breaking the ore from large size into smaller size that suitable for further separation process. The liberation of the gold from host rock and veins ore are needed in order to achieve optimum recovery. For instance, gold ore minerals can be liberated from the host rock ore at degree of -0,074mm of sieve size fraction (Bargawa and Hardiyanto, 2017).

2.3 Geology of Gold

2.3.1 Properties of gold

Gold is remarkably precious, ductile malleable metal as it has high demand in jewelry, high tech industries and medical. That's why gold has been mined, crafted and traded for thousands of years. The increasing number of demands of gold initiate the effort towards optimizing the gold production from processing of gold concentration with significance on recovery from gold tailings.

Gold is very rare mineral as it contribute on 3 parts per billion of the Earth's outer layer. Gold is like other metallic minerals such as iron, copper, lead and tin as these metals are good conductor of electricity and heat and almost at solid state at room temperature. Gold also has malleable property which as it can be able to be pressed or hammered into any shape without cracking and breaking. Besides, it ductility is higher as it can be being stretched out into thin wire and will not become brittle upon this process. The density of gold is 19.3 g/cm^3 which make the weight is over 19 times over water and almost twice as heavy as lead as density of lead is 11.34g/cm^3. The hardness of gold is quite low which is in between 2.5 to 3 as it slightly harder than a fingernail but not as hard as a glass or coin. The melting point and boiling point of gold is 1060^oC and 2660^oC.

However, the main attraction of the gold is the color itself as the color is bright yellow with a soft metallic glint that suitable for jewelry.

2.3.2 Mineralogy of gold

The mineralogy of gold is the important part in determination of processing to separate gold from the host rock. From the metallurgist point of view, the gold ore can be divided into refractory and free milling types (Vaughan, 2004).

The principal moderately easy to treat and give great gold recoveries around 90%, while refractory ore are hard to treat and give gold recoveries of below 90%, at times significantly less than half. Most metallurgist concern hard-headed mineral are those where the gold somehow secured in sulfide part. In present day times, the advances strategies utilized are pressure oxidation and bacterial. (Vaughan, 2004)

The mineralogical information additionally must be estimated in combination with the metallurgical test work program results to ensure that right processing technique are used and the best processing technology and flow sheet techniques are adopted and absorbed into the last outline plant. (Adam, 2005).

The ore deposit and mineral attributes are advantageous with a specific end goal to make sense of the sort of mining method should be utilized, the procedure of ore engaged with the extraction and all the substance that is fundamental for the gold extraction. To get a decent gold of extraction, it is vital to know mineralogy of the ore on the grounds that each ore deposit or mineral has an alternate angle (Marsden and House, 1992).

The science of the mineral will give minor elements dispersion, natural contamination and ideal grade concentrate. Other than that, the data about the grain size of the ore should be freed is essential to get the important mineral. For the gold recovery choice, the mineralogical factors that influence the decision of the mineral is metal focus, the science

of the mineral and the other mineral in the ore, the size grain dissemination and ore relationship with other (Rusyadi, 2016).

The processing methods for the gold ore which regard to the mineralogical attributes should be studied either the gold existing in complex, free-milling and refractory ore. In light of this, the gold is classified into three categories in Table 2.1 (Brooy et al., 1994).

Table 2.1 Types of Gold Ore

Types of gold ore	Example
Complex	Oxygen consuming Cyanide consuming Preg-robbing
Free-milling	Sulphide Oxide
Refractory	Highly-refractory Semi-refractory

The refractory ore has been arranged as free-milling, midly refractory, moderatey refractory and highly refractory (Vaughan, 2004). The table 2.2 beneath demonstrates the rundown of ordered gold ores.

Table 2.2 Ordered of refractoriness

Refractoriness	Recovery of gold (%)
Highly refractory	<50
Moderate refractory	50 - 80
Midly refractory	80 - 95
Non-refratory (Free-milling)	>95

The mining organization regularly has a constrained decision to introduce the treatment determination for the exceedingly refractory as to expand the gold recovery to the standard level by utilizing oxidation or roasting keeping in mind the end goal to manage the cost of adequate tonnage and grade end up conservative to help the improvement process. For mildly refractory, it is not prudent to introduce the treatment since it just increments the recovery by 5% or 10% (Rusyaidi, 2016).

2.3.3 Gold Recovery Methods

There are numerous approaches to recover the gold from the ore either in chemically or physically extraction. The methods considered predominantly include the physical detachment of gold from "gangue" mineral utilizing gravity separation techniques. Gold has a high specific gravity (19.3 g/cm3) in relationship to most normal gangue minerals and along these lines it appropriate for gravity processing. The high volume of throughput of

alluvial gold ore is the appropriate for this sort of mineral processing. The factor of certain gold grain qualities impacts the productivity of gold recovery methods particularly for the gravity separation. The impact of density upon the conduct of a gold grain will diminish as the surface zone to mass proportion increments. Gold is ordinarily flakier with diminishing grain size and not circular. The malleability of gold keeps the state of gold keep up as opposed to cracking because of stacking and effect. This unpredictable shape prompts porosity; pits and pores are regularly infilled with bring down density material bringing down the density of the composite molecule. The flaky shape, porosity and hydrophobic surface properties can regularly cause the gold to buoy and it is a noteworthy issue for fine grained gold. The mineralogical character of the gold is frequently not considered when arranging a processing plant if the gold is relating admirably to standard gravity and cyanidation process. Be that as it may, if the recovery level of gold is poor (<80%) the mineral is named "refractory" and an itemized mineralogical examination winds up fundamental (JMitchell,Ej Evans,& MT Styles,1997).

2.3.4 Jigs

A jig is portrayed as a 'prevented settling machine used to separarate concentrate minerals from encourage material'. It comprises of a shallow, level plate with a punctured base plate through which dilute is beat up and down. This reason the heavy minerals to move downwards and the lighter minerals to stay at the highest point of the beating fluid. The heavy minerals are drawn through the base plate and the light minerals disregard the best as tailings. Jigs are viable in the processing of material in the size range 25mm to 75µm. Material is best pre-screened and handled as isolated coarse and fine fractions.

2.3.5 Sluices box

The sluices box is most basic techniques for gravity separation of gold from alluvial rock. They are cheap and large modest to make, simple to work and require insignificant specialized learning to look after (Hannock, 1991). Basically, a sluices box comprises of slopping open rectangular flume with consistently separated transverse bars through which a weaken slurry of water and alluvial rock streams. Gold and other heavy minerals are more often than not caught in the upstream side of the bars. These are consistently evacuated by raking or wiping out the sluices box riffles.

2.3.6 Spiral Concentrator

The spiral concentrator is depicted as a "low feed rate, low density of feed" streaming film gravity separator. It comprises of a helical course of adjusted semi-roundabout cross-segment, more often than not with in the vicinity of 3 and 5 finish 'turns' (Wills, 1992). Material is encouraged onto the highest point of the spiral as a slurry with regularly 25% to 30% solids by weight. As the material streams spirally downwards, the particles stratify because of factor, for example, outward power, differential settling, and hindered settling and switch characterization. There is normally a density degree over the profile of the spiral with heavy minerals beside hub and minerals of lower desnity being cleared to the external edge. Concentrate, middling and tailings are gathered with utilization of movable splitter plates. The viable size of gold feed is extend in the vicinity of 3mm and 75μm and generally productive (Hanif, 2014).

2.3.7 Bowl Concentration

. The machines use the standards of a rotator to upgrade the gravitational power experienced by feed particles to impact detachment in view of particle density. The key segments of the unit are a cone molded "concentrate" bowl, turned at fast by an electric engine and a pressurized water coat incorporating the bowl. Feed material, ordinarily from a grinding machine release or cyclone underflow bleed, is fed as a slurry toward the focal point of the bowl from above. The feed slurry contacts the base plate of the vessel and, because of its turn, is pushed outward. The external furthest points of the concentrate bowl house a progression of ribs and between each combine of ribs is a section. Amid task the lighter material streams upward finished the furrows and heavy mineral particles end up caught inside them. Pressurized water is infused through a progression of extraneous water bays along the border of each furrow to keep up a fluidized bed of particles in which substantial mineral particles can be proficiently focused. The Knelson concentrator normally works as a batch process, with lighter gangue material being persistently released by means overflow and a heavy mineral concentrate intermittently evacuated by flushing the bowl with water. A bowl concentrator comprises of a pivoting chamber that isolates heavy minerals from light minerals by a mix of diffusive power and wash water activity.

2.3.8 Drum Concentrators

The Mozley Multi-gravity (MGS) comprises of a tilted drum that decreases somewhat to the downslope end. The drum all the while pivots and is shaken longitudinally.

Slurry is added to the upslope end and as it moves down the drum it isolates into heavy and light minerals. The heavy minerals answer to within mass of the drum, where they are pushed to the incline end by scarpers. The light mineral remains entrained in the wash washer water and answer to the downslope end. The MGS has been compared to as shaking table wrapped round itself into a drum. The MGS can be utilized to process material in the size range 1mm until to $1\mu m$. (Hanif, 2014)

2.3.9 Shaking Table

The wet table is the basic type of shaking table which is water as a medium of separation. It comprises of a level table or deck with parallel riffles to trap the heavy minerals. The deck is vibrated longitudinally and slanted horizontally amid activity. A punctured pipe sustains wash water from the upslope side. The slurry feed is presented at the top upslope corner. The minerals in the encourage isolate. The heavy minerals sink to the deck, move along the riffles and are released over the finish of the deck. The light mineral, entrained in the water, ignore straight the riffles and down to the base and so to the tailings. It is appropriate and successful in the handling of material in the size range 3mm to 15µm. (Hanif, 2014)

2.3.10 Froth Flotation

Froth flotation is a broadly utilized preparing strategy which abuses diverse in the surface properties of minerals. Minerals with hydrophobic surfaces (either in characteristic or because of chemical treatment) append to air bubbles going through a suspension and

buoy to the surface to shape a foam. Gold grain surfaces are regularly covered with a hydrophobic natural layer or iron oxide coatings and some are drained free of polluting influences, (for example, silver) leaving an edge of unadulterated gold, these render the surface hydrophobic. (Hanif, 2014)

2.3.11 Amalgamation

Essentially, amalgamation is the act of carrying free gold particles into contact with mercury. At the point when clean gold comes into contact with mercury, the two substances blend to shape a compound called amalgam. An amalgam is essentially a composite of gold and mercury. The gold actually is broken down into the mercury. This permits the gathering of little estimated particles of gold. Toward the finish of the activity the mercury and gold amalgam are gathered after which the two are isolated, and the mercury has been reused back. Presently bigger gold and nugget would not be totally changed over and just a thin covering of amalgam forms. Be that as it may, huge pieces ought not to be caught with mercury, it ought to be spared to use in recouping fine estimated gold.

2.3.12 Cyanidation

Gold cyanidation is the metallurgical process where involving the extracting of gold by using chemical. Gold cyanidation free the gold ore from interlock towards the host rock. Cyanide, as an exceptionally dilute sodium cyanide solution, is utilized to break down and isolate gold from metal. The procedure used to separate gold utilizing cyanide was produced in Scotland in 1887, and was first utilized as a part of huge scale business mining by the New

Zealand Crown Mines Company at Karangahake in 1889. Cyanide leaching is thought to be a substantially more secure contrasting option to extraction with fluid mercury, which was already the principle technique for extrating gold from ore. Cyanide leaching has been the predominant gold extraction innovation since the 1970s, eventhough little scale and mineworkers keep on using mercury in a few zones of the world. Over 90% of mined gold is extricated from mineral utilizing cyanide. Table 2.3 shows the effecting of these rovery methods towards the effective size.(Mitchell, Evans and Styles, 1997)

Table 2.3: Percentages of Gold Recovery

Method	Size Range	Percentages of Recovery
Sluices boxes	2500µ to 1000µ	-<100µm = 20% <1000µm = 96%
Spiral	3000 to 75µm	65 to 80%
Jigs	2500 to 75µm	100µm = 50% 1000µm = 98%
Shaking Tables	3000 to 75µm	20 to 40µm = 20% >40µm = 90%
Bowl Concentrators	6000 to 30µm	>90%
Cyanidation	<200µm	805 to 90%
Amalgamation	1500 to 70µm	<75µm =65% <500µm = 98%

2.4 Peranggih Oxide Exploration

Before independence, Malay land was known as the “Golden Peninsular” which means all activity of mining producer has been started before Independence Day. It is due to the formation of gold deposit happened due to the hydrothermal fluids in the Central Gold Belt. It located across the state of Pahang and Kelantan within the central gold belt. In Peranggih, Pahang, the regional shearing structure is the same with Selinsing and Buffalo Reef gold deposit. Before independence, Malay land was known as the “Golden Peninsular” which means all activity of mining producer has been started before Independence Day. Malaysia had effectively settled itself as one of the essential maker before the improvement of the considerable gold-fields. Most of the gold generation evidently originated from the conditions of Pahang and Kelantan inside the Central Belt. Gold mineralization in the Central Gold Belt is for the most part sorted as a low mesothermal lode gold deposit because of its structural and topographical setting. In Raub, Selinsing and Buffalo Reef are among the old alluvial mining goldfields which are currently being returned to for the existent of low grade bulk-mineable gold deposits It is due to the formation of gold deposit happened due to the hydrothermal fluids in the Central Gold Belt. It located across the state of Pahang and Kelantan within the central gold belt.

In Peranggih, Pahang, the regional shearing structure is the same with Selinsing and Buffalo Reef gold deposit. Peranggih was generally mined in the late 1980's and into the mid 1990's by local artisanal miners. Utilizing traditional sluicing and residual tailing, the gold was recovered and other proof demonstrated that considerable work had been done all throughout this period Hence, all the exploration procedure includes oxide trenching,

geological mapping and surface sampling has been done in order to estimate whether the land is profitable to mined or not. Resources model for Peranggih has been generated to indicate potential minable oxide materials with identified high gold grade zones surrounded by a halo of lower grade mineralization. All the feasibility study has been involving in order to open the mined at Peranggih North. Figure 2.1 shows geological mapping of Peranggih Site.

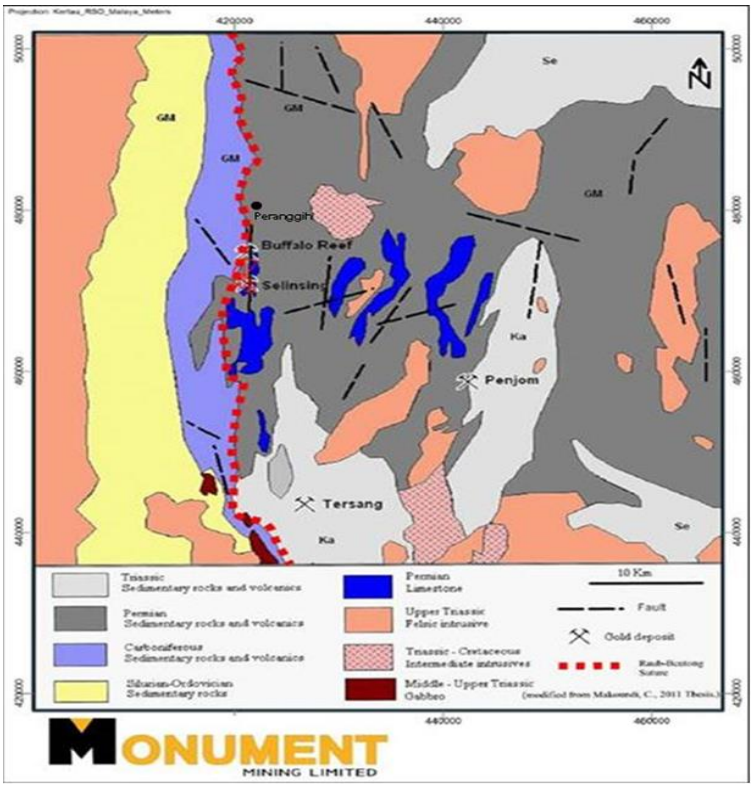

Figure 2.1: Geological Map of Peranggih Site (Monument Mining, 2018)

In 2018, boring project is intended to catch up an as of late finished 5m x 5m close separated RAB boring program at a memorable mining site ("the 2017 boring system"), of which empowering drill comes about were declared in November 2017. The 2017 boring system has effectively portrayed a zone of higher review gold material at Peranggih North

zone by testing 150m strike length x 80m width of the mineralization (Monument Mining, 2018)

The 2018 boring project incorporates 700m Diamond Drilling (DD) from 16 bore openings infill boring and 2,800m. Reverse Circulation (RC) drilling from 52 bore openings augmentation boring. All composed investigation bore gaps are slanted and plunging 60 degrees toward the west (azimuth 270 degrees), expecting to capture the mineralization as close as conceivable of an opposite capture. Penetrate profundities are going from 20m to 90m. (Monument Mining, 2018)

The infill boring with dispersing of 20m x 20m to 20m x 40m, or locally 10m x 10m out of a recognized high review gold region, is intended to additionally test strike and down plunge augmentations of the recognized high review mineralization at Peranggih North, to test progression of the mineralization, and to confirm augmentation down plunge and along the strike for different zones being trenched and penetrated already including Peranggih South, North 114 and NW. Figure 2.2 shows the location of the planned drill holes in relation of four places.(Monument Mining, 2018)

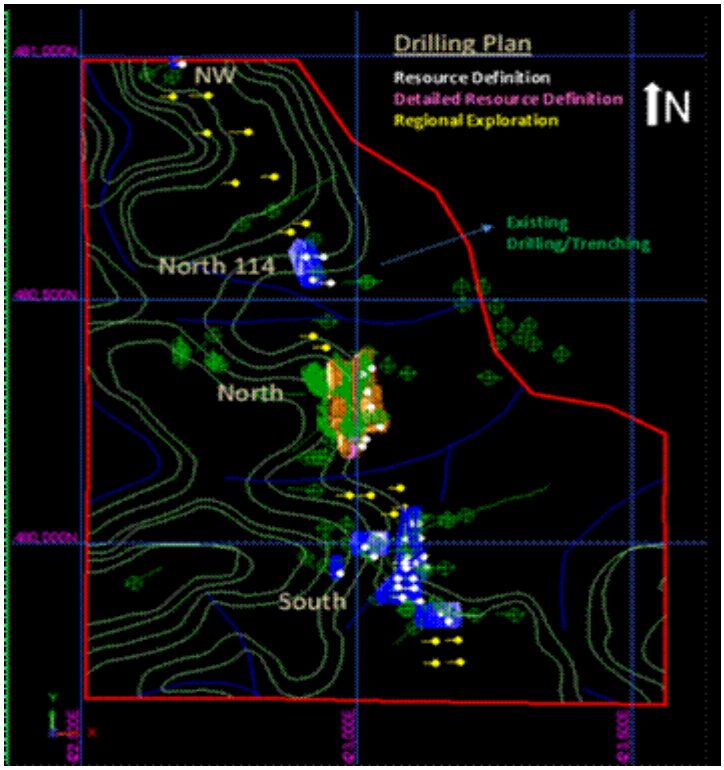

Figure 2.2: Location of the drilling program in Peranggih site(Monument Mining, 2018)

. Through these itemizing works, the in-fill boring is focusing to outline Demonstrated Assets at the regions where the underlying inside elucidation has been finished in view of scanty territorial boring and trenching. The augmentation penetrating with separating of 50m x 100m is wanted to comprehend mineralization structure and to recognize provincial investigation focuses on and between the four zones inside the same Peranggih oxide framework in view of past investigation work. (Monument Mining, 2018)

The Peranggih Prospect has been distinguished as another Gold Field that can possibly have a noteworthy mineralized aqueous breccia framework. It has 1.2 km hit length with width changing from 25m to 50m, and profundity from 40m to 70m. The mineralization happens in the same territorial shearing structure facilitating Selinsing and Buffalo Reef deposits.

2.5 Complex Gold Ore

Complex gold ore is the ore that contain cyanicides and oxygen consumers or even called as copper-gold-ore. The formation due to the geological situation where it contains copper and gold as well as cobalt, uranium and bismuth. The use of cyanide towards this ore is precluded due to the high solubility of many common copper minerals in alkaline cyanide solution(Vaughan, 2004). Usually gold is recovered from host ore is by smelting.

However, the oxide ore usually use smelting in order to completely extract gold from the ore. The complex gold ore is refer to any type of gold ore that have difficulties to extract. The most difficult is cooper-gold-ore as treatmet is near surface oxide where it contain copper oxides, carbonates and metallic copper. These minerals are much more soluble then sulphide ore. (Vaughan, 2004).

Besides, the ore that have oxygen and cyanicides end users are also describe as complex ore. The formation of these complex ore due to the diiference in geological situations and also to copper and gold that include the amount of cobalt, uranium, bismuth and rare earth element. (Vaughan, 2004).

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Chapter 3

METHODOLOGY

3.1 Introduction

Methodology is about theoretical analysis on the method that being used in this significance project. It includes the principles associated with a branch of knowledge as well as the theoretical analysis of the methods. For this project, the method that include are preparation step, process step and analysis step.

In the preparation step, the sample is being taken out from the project site by grab sampling. The site in which in Peranggih, Pahang where approximately content high grade of gold ore. Then, it includes the process of primary crushing by using jaw crusher before coming towards secondary crushing by using cone crusher. The process includes the process of sieving of 12 size fraction before carrying towards polish section preparation.

The last one which is analysis step are include morphological studies which are polarizing microscope and scanning electron microscope. Besides, loss on ignition is also been test out for the bulk characterization before tested by using x-ray fluorescence instrument. X-ray diffraction was done as to know the phase identification of the sample. XRF and XRD is been carry out by technicians. Gas pycnometer instrument was also being used as to indicate the specific gravity of the sample.

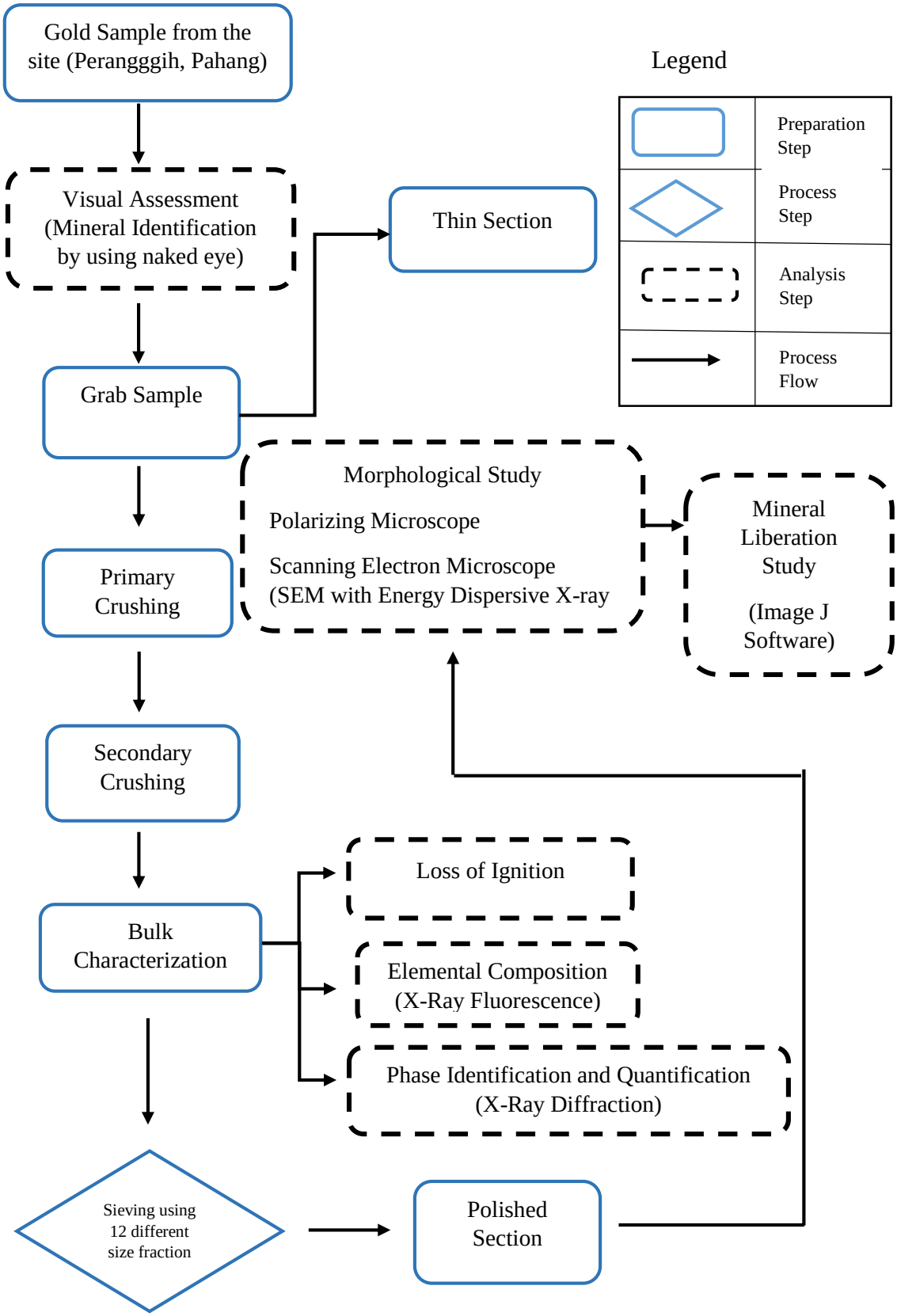

Figure 3.1: Flowchart portraying the stages included

3.2 Site Sampling of Raw Material

The current investigation involved the sampling and characterizing on different location of Peranggih site. Most of the sample collected from broken or intact rock as well as the soil. Approximately about 100kg of the sample have been collected as to represent the whole area which has highly most concentrated gold. The location has been choosing by referring based on the previous research by Selinsing Mine Manager Sdn Bhd.

3.3 Site Sampling

This grab sampling method has been the practical way to collect sample which can be used to ensure the presence or the distribution of gold in a gravel exposure. This method consists of taking of broken or intact rock as well as the soil by using shovel and plastic bags that had been given by Selinsing Mine Manager authorities. Approximately about 100kg of the samples of first batch which equivalent to 5 plastic bags and each plastic bag is equal to 30 scoops. Besides, the samples come from 9 points as to ensure the entire location shown by the geologist was covered. The points were recorded by using GPS tracking device. The second batch with the same weight was been collected as references. The location of Peranggih site is shown in Figure 3.2