GEOLOGICAL DEPOSIT SURVEY REPORT ON GOLD MINE OF PT. ORO KNI IN WEST HALMAHERA, INDONESIA

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K&I INTERNATIONAL

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Prepared

by

K&I INTERNATIONAL CO., LTD.

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ABSTRACT

This report describes the result of geological deposit survey on the mine lots of PT. ORO KNI, located in West Halmahera, North Maluku, Indonesia. The survey has been conducted for the 1 year period(2012～2013) by the geological survey team of K&I International Co., Ltd., the exclusive investor to PT. ORO KNI.

The registered mine lots are No. 98 and 99 permit area, covering the area of 20,000ha. The relevant KP was obtained in April, 2007 and this was changed to IUP in August, 2010. A task area of geological deposit survey is 14,000ha.

Based on the geological features of the survey region, the Gosowong Formation(Upper Miocene, Tertiary period), the Kayasa Formation(Pliocene, Tertiary period), the Tuff Formation(Pleistocene, Quaternary period), and the volcanic rocks and alluvium(Holocene) exist. Gold deposits are situated in andesite of the Gosowong Formation.

According to a detailed geological survey, which was carried out on the prospective spots from a regional geological survey, 2 Au anomaly zones and 15 anomaly points were obtained in Tarusi and other areas. Besides, a gold-bearing quartz deposit(average vein width: 15m, average Au grade: 5.4ppm, length: 1,200m) was identified in Sabeta area.

With respect to the Sabeta deposit, this is believed as a low sulfidation gold deposit and a quartz-chlorite phase is expected to exist in the deep part, since this is located about 200m higher than that of NHM's mine.

The possible gold ore reserves in the Sabeta deposit is expected to be 8.35 million ton and the possible metal reserves is 45.09 ton.

A detailed surface geological survey for Ngibut area(Zone 1), detailed geochemical survey for Sosam area(Zone 2) and Awiri area(Zone 5), and trenching for 17 spots(length: 850m) in Tarusi and Donghar area(Zone 3) are firstly planned. Also, 15 boreholes for drilling(total depth: 3,000m) is also planned to understand the development situation of deep part in Sabeta area.

The related mine lots are located in the neighborhood of the highest grade epithermal gold field. Therefore, if more advanced staff and technology are employed in the future geological deposit survey, there is a very strong possibility of satisfactory result.

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1. INTRODUCTION

K&I International Co., Ltd.(hereinafter referred as K&I), located in Seoul, Korea, has solely invested in a gold mine in West Halmahera, Indonesia through its Indonesian subsidiary PT. ORO KNI. Since 1999, K&I has carried out the relevant exploration of bituminous coal, iron, gold, petroleum, silicon and diatomaceous earth in Indonesia and also has participated in the development of gold mines in Ghana, Africa, in partnership with one of mining companies in the United States.

Thanks to the extensive explorations, K&I has obtained exploitation permits for two diatomaceous earth mine concessions in West Halmahera in July 2008 and has tried to mutually develop these concessions with world major companies from the United States, Europe and Japan.

Against the upward trend of gold price from the mid-2000(Figure 1-1), K&I has obtained gold mine exploration permits in April, 2007 and initiated an independent gold survey in Indonesia.

According to the survey result in the period of 2007～2008, K&I has discovered gold ore bodies in Sabeta and Taidudu area and executed a surface geological survey along with trenching. As a result, high grade gold of Au 1～42g/ton was produced, but the survey was a bit insufficient as a basic resource for full exploration and exploitation.

Nonetheless, in the eastern district of K&I's gold mine, PT. Nusa Halmahera Minerals(NHM, Australian company) has produced 14 tons of gold in 2011 and, judging from the exploration result, a large gold ore deposit is expected to be discovered on the outskirts of NHM′s mining concession.

Therefore, an extensive and systematic geological deposit survey has been started by 5 internal and external geologists over the area of 14,000ha, except for the northernmost Quaternary cover area(Holocene) out of the whole mine lots(20,000ha).

Accordingly, the purpose of this report lies in carrying out a geological deposit survey on the mine lots, located in West Halmahera, Indonesia and in more accurately understanding the development situation of deposits. Furthermore, this report can provide fundamental information for the full-scale development of the relevant mine lots.

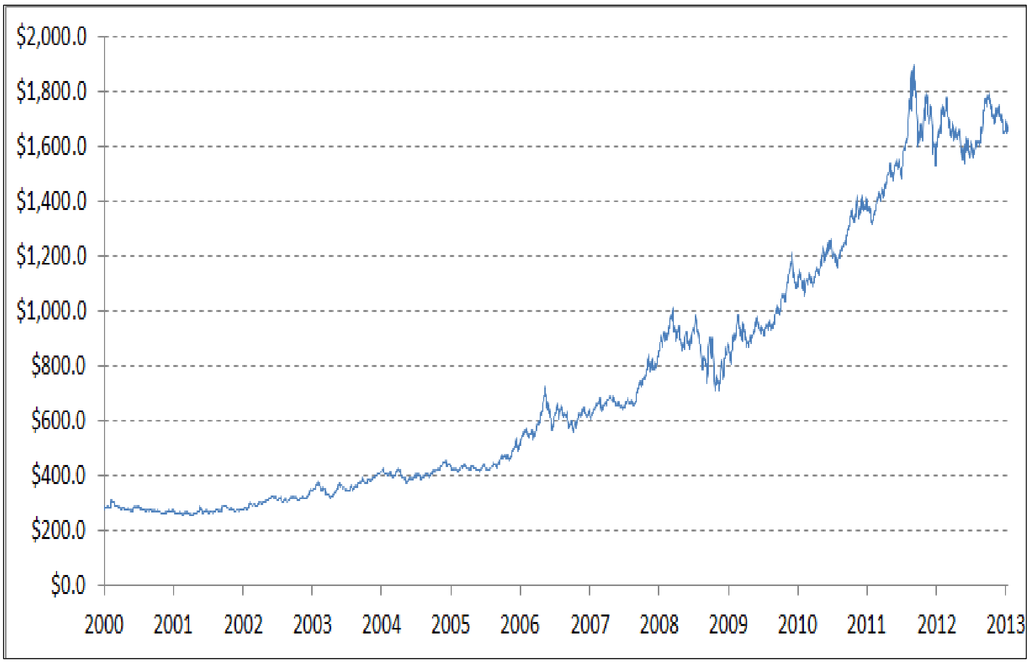


Figure 1-1 Gold Price in International Market
($/oz.t.; Jan. 2000～Jan. 2013)

2. LOCATION AND TOPOGRAPHY

2.1 Location

The related gold mine lots are located in South Ibu and Jailolo, West Halmahera, North Maluku, Indonesia. According to geographical coordinates, the mine lots lie in 127°34′16″~127°37′59″(east longitude) and 01°05′11.8″~01°20′52″(north latitude), as shown in Figure 2-1.

Figure 2-1 Location Map of Survey Region

Concerning the transportation, it takes about 7 hours from the Incheon International Airport(Incheon, Korea) to the Soekarno-Hatta International Airport(Jakarta, Indonesia). Then, one can arrive in Ternate in about 5 hours by flight, such as Sriwijaya Air or Garuda Air. From Ternate to Jailolo, it takes about 1 hour by speedboat. A mine field office of PT. ORO KNI is located in Jailolo(Figure 2-2 and Photo 2-1).

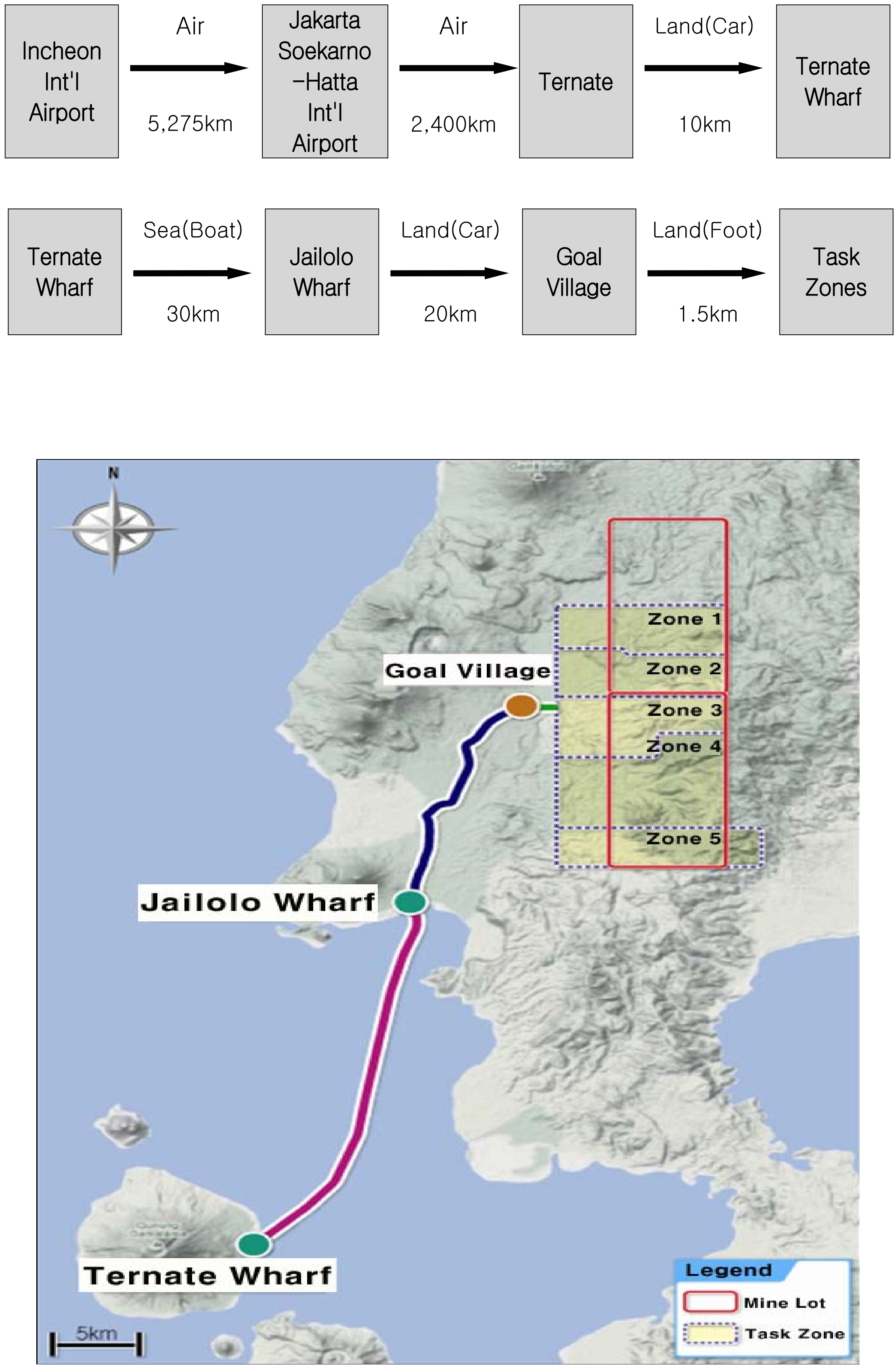


Figure 2-2 Route to Survey Region

Jailolo Wharf

National Hwy of West Halmahera

Unpaved Approach Road

Mine Field and Base Camp

Photo 2-1 Route Photo to Survey Region

2.2 Topography

2.2.1 Mountain System

A mountain system is developed by the influence of geological structure relating to the subduction of the plate near the Halmahera Island. In addition, there has been the influence of weathering and erosion of wall rock and the secondary geological structure, resulted from the movement of the main geological structure.

The mountain system is low ranging from 100m to 680m, but a sharp slope emerges. In particular, the eastern part is lower than the western part and the system has developed into the southwest direction, hinting the maturity of system(Figure 2-3).

2.2.2 Water System

A water system is largely categorized into the main system (north-south) and watersheds (east-west), diverging from the main system. Some streams are temporarily arid during the dry season.

According to its type, the water system generally falls into dendritic drainage and in terms of drainage density, it records at a medium value. This might be came from the fact that the stratum is susceptible to weathering with many valleys between steep sloped ridges.

The water system develops from northeast to southwest in Zone 1 and watersheds reach to Ngibut stream(or Ake Ngibut) and then join to Lamo river with sparse drainage density. The east-west water system grows in Zone 2 and Zone 3 and its watersheds reach to Ngelewer and Gola stream, then meet Lamo river with medium drainage density. In Zone 4 and 5, the water system develops from southeast to northwest and its watersheds reach to Gola and Wid stream and then come over to the Lamo river with medium drainage density(Figure 2-4).

2.3 Climate and Vegetation

The survey region is located between north latitude 1° and 2°. Yearly average temperature is 25～30℃ and yearly rainfall is 2,500～3,000mm.

In terms of climate, there are two seasons in the survey region, that is, the dry season(June～October) and the wet season(November～March). The period of April and May is a transition season. Precipitation concentrates during the wet season, but it is a typical tropical rainforest climate since squalls are very frequent in this region.

Vegetation distribution and density are analyzed by acquiring NDVI (Normalized Difference Vegetation Index) values from the relevant satellite images. In particular, this analysis is based on the fact that green plants have strong differences in terms of reflectance in visible and near-infrared regions.

Namely, if red(visible) gets dark, that indicates there is no vegetation, and if green(near-infrared) gets dark, there is high density of green plants. In general, the actual value of forest is about +0.5 and in case of quasi-forest and grassland range from +0.25 to +0.4. The survey region is classified in green forests under the tropical rainfall climate, given the fact that the two-thirds of the country are tropical rainfall forest regions in Indonesia(Table 2-1 and Figure 2-3).

Note) The calculation of NDVI is as follows:

※ NDVI=(NIR-VIS)/(NIR+VIS)

cf.) NIR-Near-Infrared Region, VIS-Visible Region

Table 2-1 Normal Vegetation Distribution

	Minimum	Maximum	Average	Standard Deviation
Analysis Value	-0.36	0.51	0.19	0.23

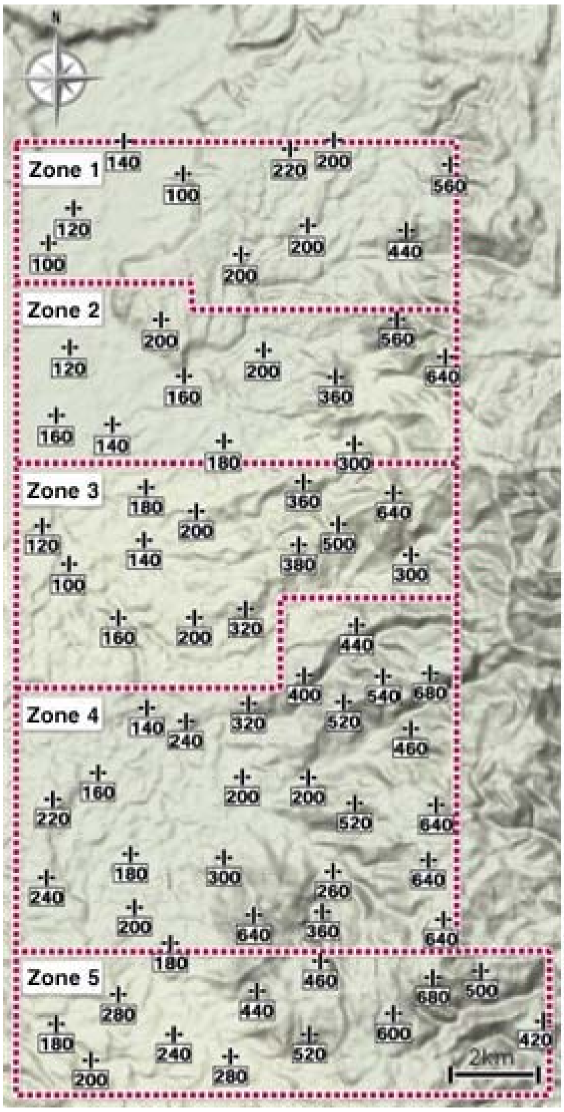
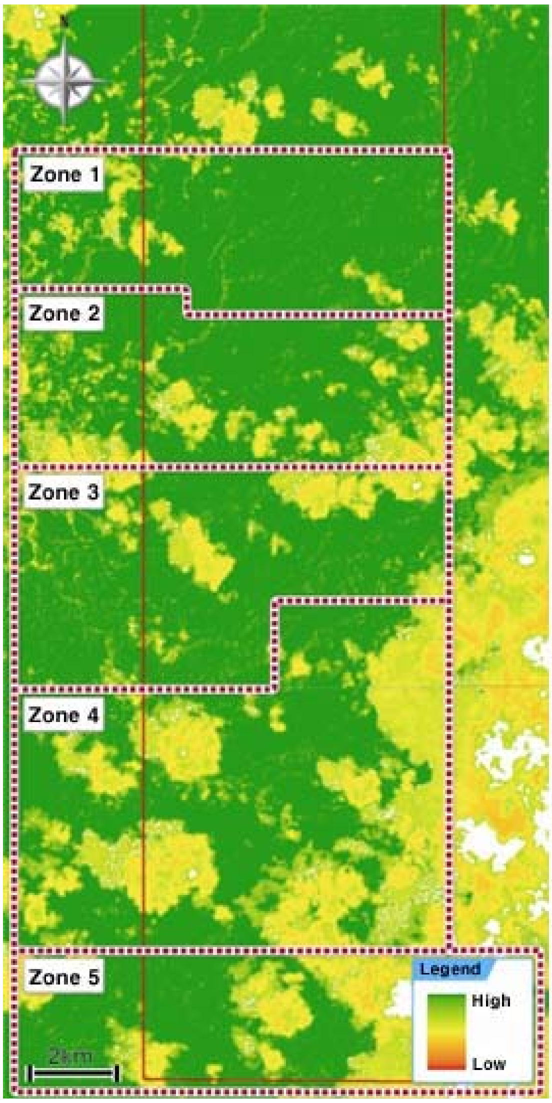
Mountain System	Vegetation
	

Figure 2-3 Mountain System and Vegetation Distribution of Survey Region

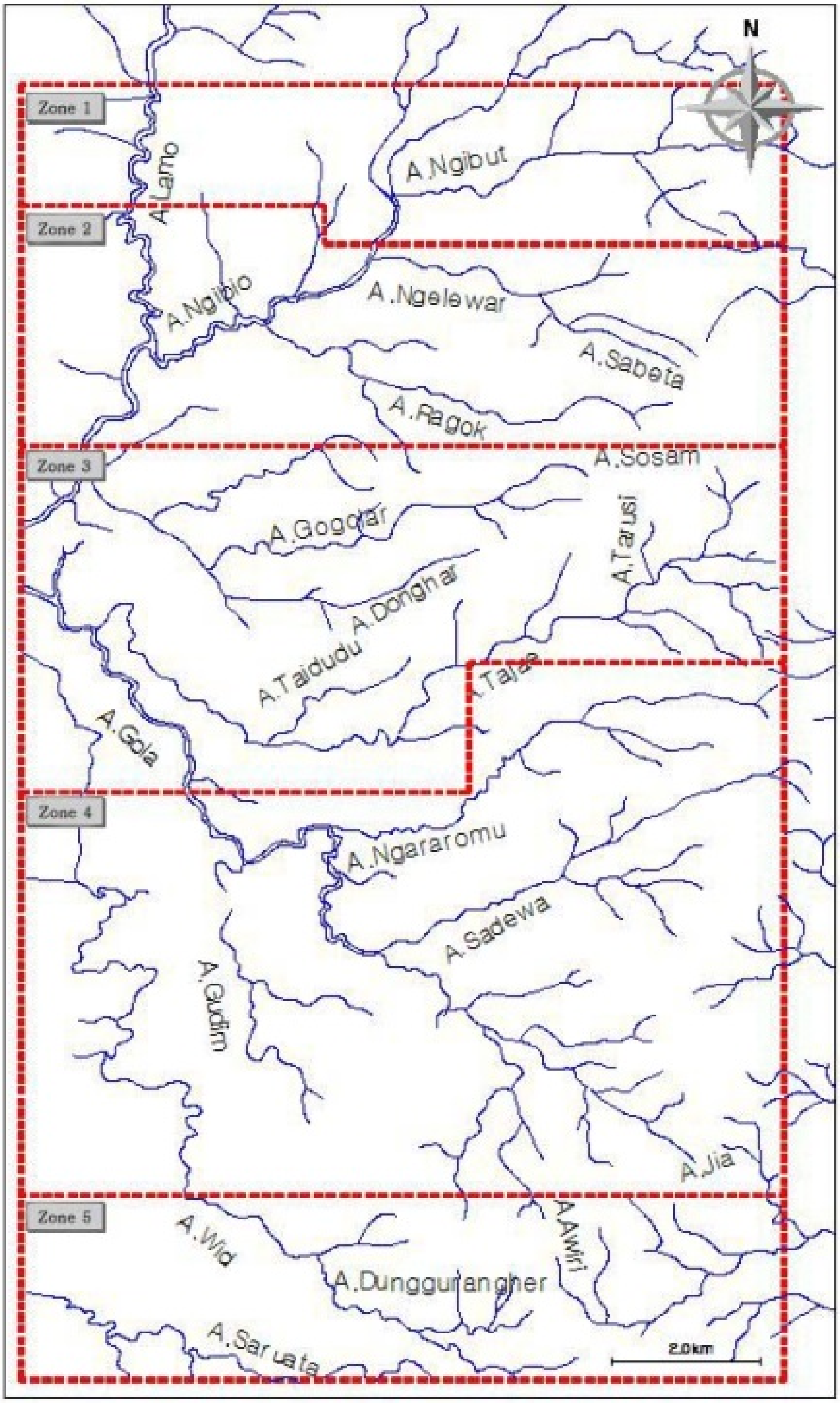


Figure 2-4 Water System of Survey Region

3. SITUATION OF MINE LOT

The related rectangular mine lots are situated in South Ibu and Jailolo, West Halmahera, North Maluku, Indonesia, covering the area of 20,000ha with No. 98 and 99 permit(Table 3-1 and Figure 3-1). The relevant KP was obtained in April, 2007 and then it was changed to IUP in August, 2010.

Table 3-1 Situation of Mine Lot

Minerals	Coordinates		Area (ha)	Period	Permit No.
	Longitude(E)	Latitude(N)			
Copper and Associated Minerals	127°34'16" ~ 127°37'59"	01°05'11.8" ~ 01°13'01.9"	10,000	10. 08. 30 ~ 15. 08. 30	No. 98 West Halmahera, 2010
Gold and Associated Minerals	127°34'16" ~ 127°37'59"	01°13'01.9" ~ 01°20'52.0"	10,000	10. 08. 30 ~ 15. 08. 30	No. 99 West Halmahera, 2010

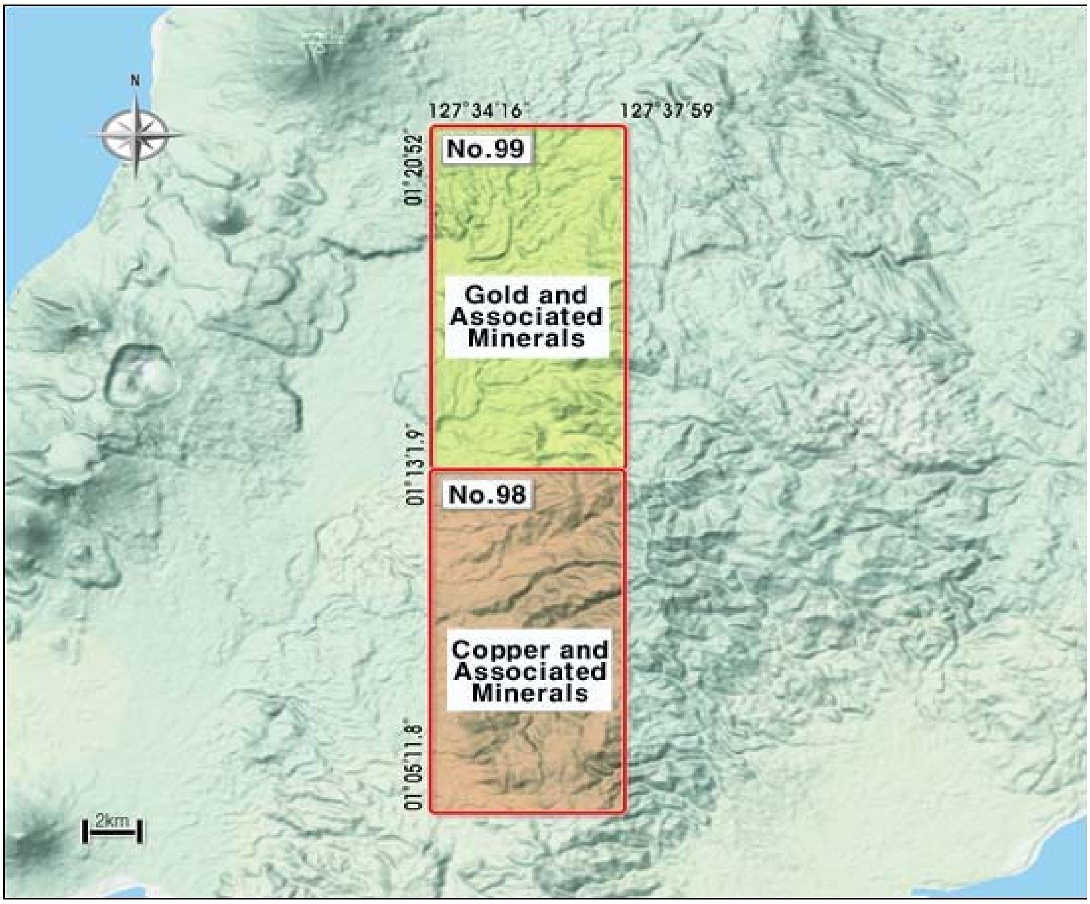


Figure 3-1 Mine Lot of Survey Region

4. SURVEY SCHEDULE

- February, 2007 : Initiated geological deposit survey by internal technical staff
- April, 2007 : Obtained KP
- August, 2010 : Changed KP to IUP
- January 5, 2012 : Organized a survey team comprising internal and external geologists
- Jan.~Feb., 2012 : Collected and reviewed previous resources and materials
- Feb.~Jul., 2012 : Performed regional geological survey
- Aug.~Dec., 2012 : Conducted detailed geological survey

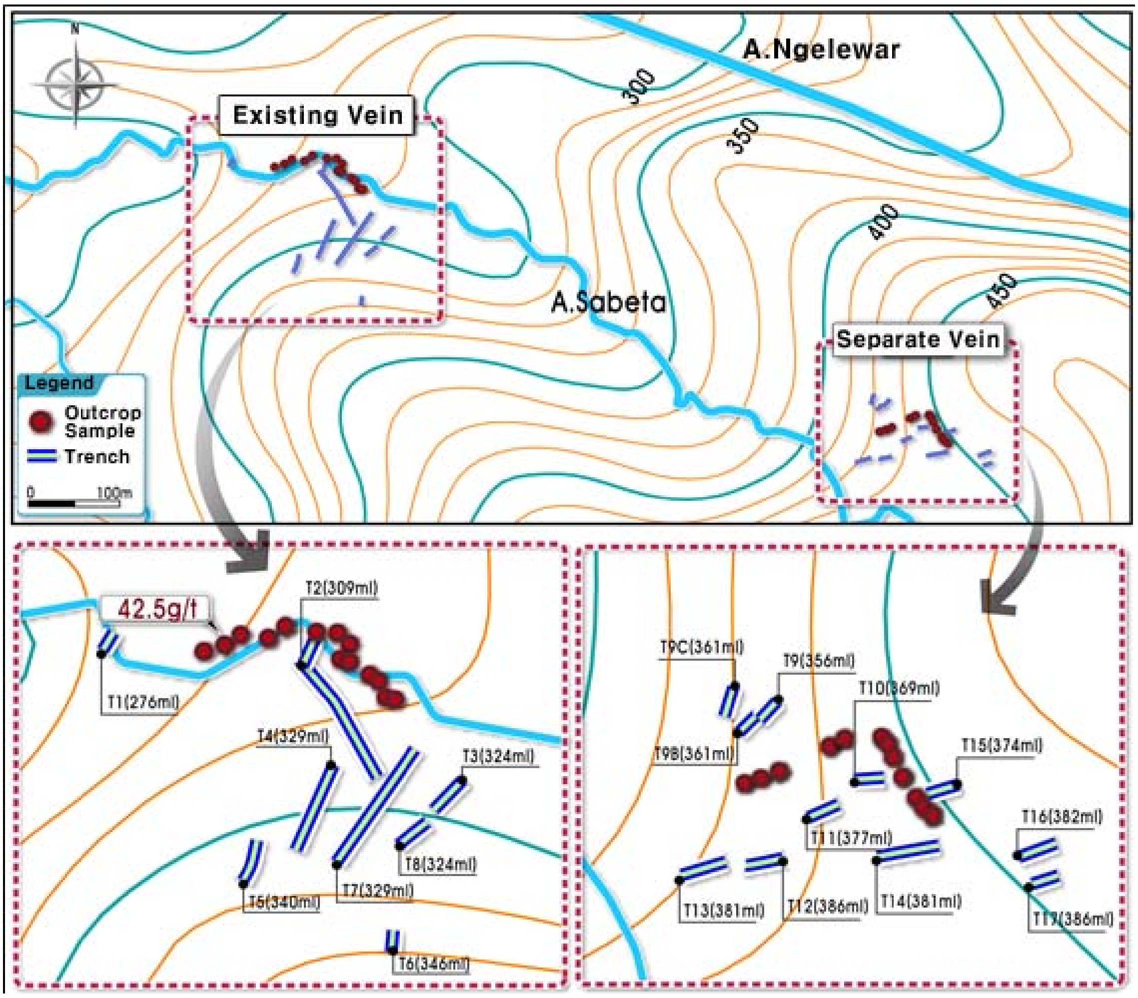


Figure 4-1 Situation of Previous Survey in Sabeta Area

Previous Survey

PT. ORO KNI has conducted a geological survey, trenching, and ore sample analysis from 2007 to 2010 in places such as Sabeta and Taidudu.

In the 2007 survey, gold-bearing quartz veins containing pyrite were found in Sabeta area(Zone 2). Also, 19 trenches were dug and ore samples were collected in 26 spots(Figure 4-1).

Based on the analysis result, high grade gold of 1.9～42.5g/ton were discovered in 4 samples. Nonetheless, trenches and ore samples were concentrated in the specific spots and hence it is presumed that the survey did not cover the whole quartz vein. Furthermore, a detailed survey was planned on the Taidudu and Tarusi area where the mineralization was recognized, but the related survey could not be conducted.

In addition, outcrops of main quartz vein in Sabeta area are divided as the existing vein(entry of Sabeta stream) and the separate vein(850m distant from the entry) and these two veins are viewed as different ones without the development of quartz vein between these two veins.

5. GEOLOGICAL FEATURES

5.1 Overview

The mine lots sit in the southern part of West Halmahera Peninsula in Halmahera island. According to the plate tectonics, the Maluku(or Molucca) Sea microplate is actively being subduced into the convergence of North Sulawesi and Halmahera(Figure 5-1). Owing to the tectonic movement, Tidore mountain in the volcanic arcs of Tidore island, Gamalama mountain in Ternate island, and Jailolo, Todoko-ranu, Gamkonora, and Ibu mountain in West Halmahera are distributed. Eastward subduction of the Maluku Sea microplate beneath Halmahera and westward subduction beneath North Sulawesi since the Paleogene period have produced four superimposed volcanic arcs in west Halmahera(Figure 5-2).

The four volcanic-sedimentary formations have been termed from the bottom, the Gosowong Formation(Upper Miocene, Tertiary period), the Kayasa Formation(Pliocene, Tertiary period), the Tuff Formation(Pleistocene, Quaternary period), and the volcanic rocks and alluvium(Holocene, Quaternary period), which remains volcanically active.[1)]

Geological distribution of the mine lots is shown below(Table 5-1).

1) AMC Mining Consultants Ltd.(Canada), 2012, Technical Report on the Gosowong Property in North Maluku Province in Indonesia, Newcrest Mining Ltd.

Table 5-1 Geological Time Table of Survey Region

Quaternary	Holocene	Alluvium, Volcanic Rocks	Unconformity	Sand, Clay, Gravel, Andesitic/Basaltic Pyroclastic Flow, Andesite, and Basalt
	Pleistocene	Tuff Formation	Unconformity	Tuff, Dacitic Pyroclastic Fall, and Pyroclastic Flow
Tertiary	Pliocene	Kayasa Formation	Unconformity	Dacite, Dacitic Lava, Dacitic Pyroclastic Fall/Flow, and Dacitic Volcaniclastic Sandstone/Mudstone/Conglomerate
	Upper Miocene	Gosowong Formation		Andesite, Andesitic Lava, Andesitic Volcaniclastic Sandstone/Mudstone/ Conglomerate, Diorite, and Ore Body
				Basalt, Basaltic Lava, Basaltic Volcaniclastic Sandstone/Mudstone/ Conglomerate, Ore Body, and Intrusive Andesite

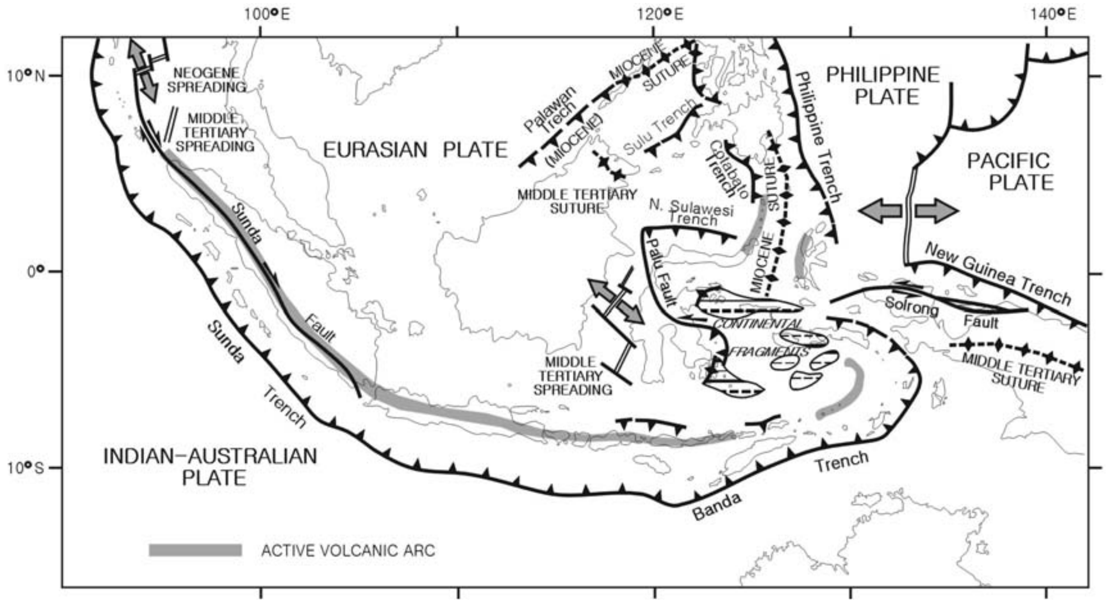


Figure 5-1 Plate Tectonics near Halmahera Island[1]

1) Hamilton W.,1979, Tectonic of the Indonesian Region, USGS Professor Paper, v.1078, p.346

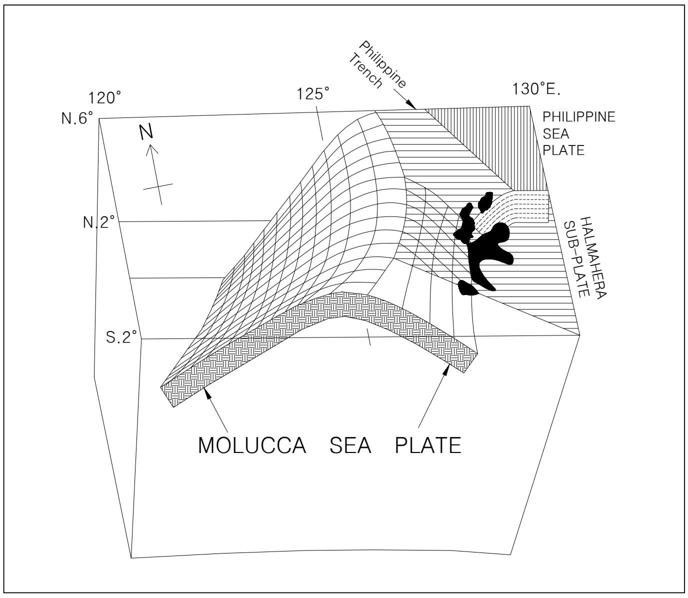


Figure 5-2 Mimetic Diagram of Subduction of Maluku Sea Microplate[1)]

The Gosowong Formation is widely distributed in the eastern part of the mine lots and the NHM's gold mine. Basaltic volcanic and pyroclastic rocks are at the lower part and andesitic volcanic and pyroclastic rocks are at the upper part. Also, dioritic stock is intruded and a gold ore body is formed.

The Kayasa Formation consists of dacitic volcanic and pyroclastic rocks and it is largely distributed in the northeastern and southern boundary of the NHM's gold mine.

The Tuff Formation, chiefly made up of pumiceous and sandy tuff, is extensively distributed in the western and northeastern part of the mine lots.

Volcanic rocks are mainly composed of andesitic and basaltic lava along with volcanic and pyroclastic rocks. These are assumed to be erupted from active volcanoes, such as Tidore, Gamalama, Jailolo, Todoko-ranu, Gamkonora, and Ibu mountain, included in the volcanic arcs of West Halmahera(Figure 5-3).

1) R. Hall, 1988, Late Paleogene-Quaternary Geology of Halmahera, Eastern Indonesia of Volcanic Island Arc

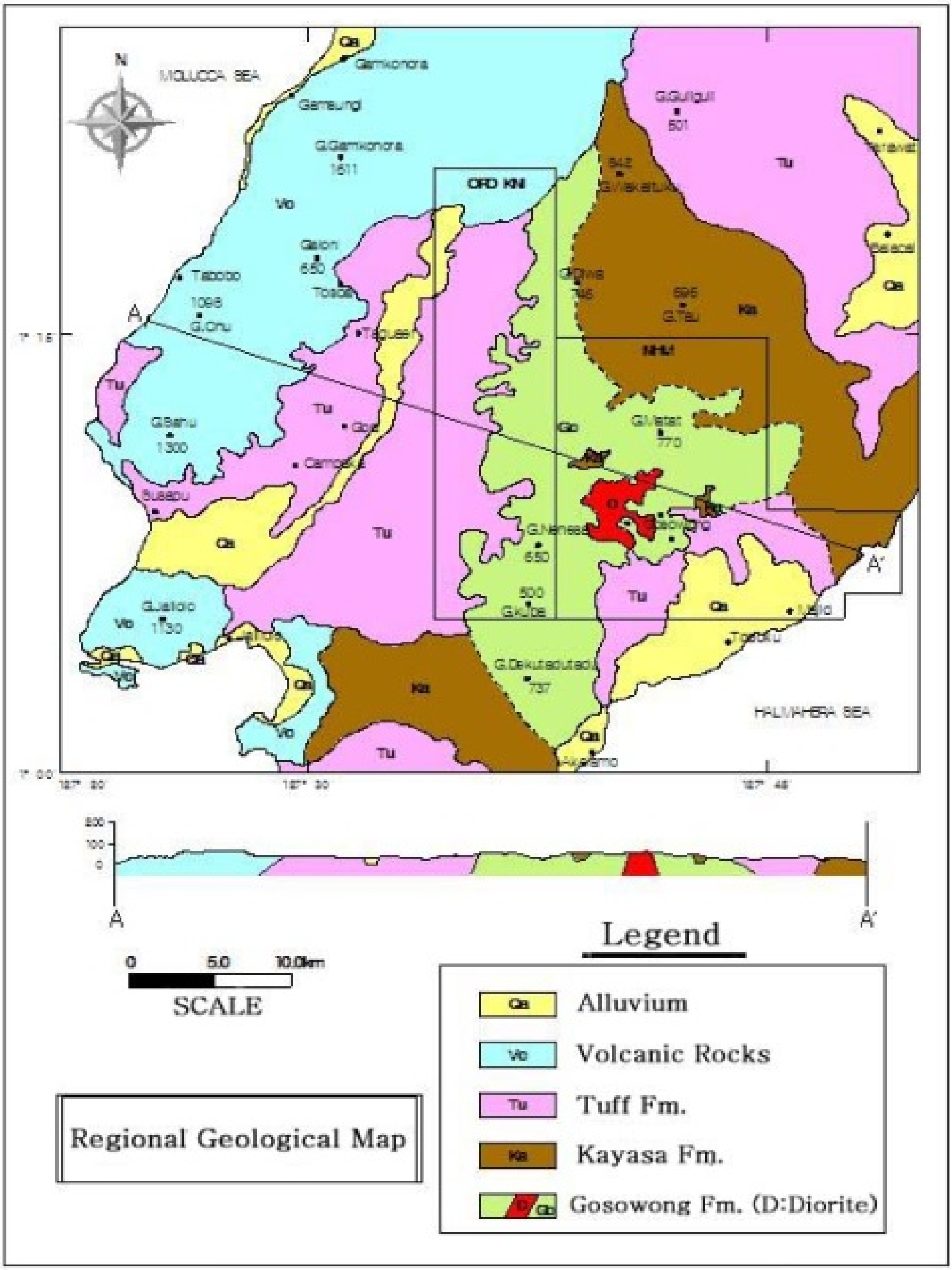


Figure 5-3 Regional Geological Map of Survey Region[1)]

1) Geological Map of the Morotai Quadrangle, North Maluku, 1980, Geological Research and Development Centre of Indonesia

5.2 Lineation

According to shaded relief images, lineation is analyzed for the regional analysis of structural lines such as faults, joints, and dikes, before a geological field study. This analysis can lead to a more economic, swift, and precise field study.[1)]

In addition, based on the lineal structure analysis, dominant geological directions are understood by measuring the lengths and angles of the respective linear structures and performing an orientation and extensity analysis per 10°.

As the result of orientation and extensity analysis in the survey region, three dominant lineal structures are observed. That is, L1 structure(N30°～40°W), L2 structure(N70°～80°E), and L3 structure(N30°～40°E), as illustrated in Figure 5-4 and 5-5.

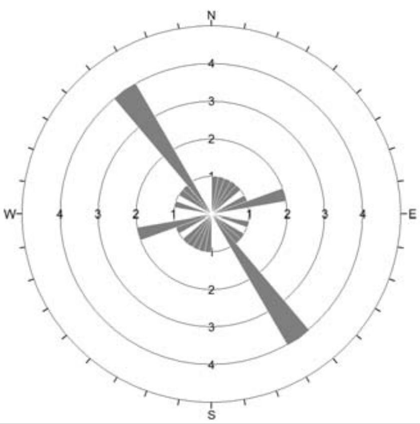
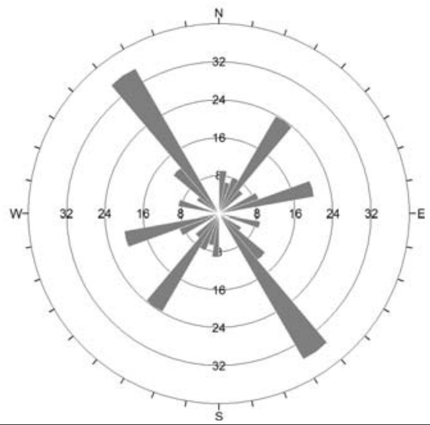
Orientation Analysis	Extensity Analysis
	

Figure 5-4 Orientation and Extensity Analysis of Lineal Structures (Rose Diagram)

1) Chung Ryul Ryoo, 2000, Possibility of Deposit Exploration by Utilizing Water System or Lineation in Indonesia, The Korea Earth Science Society

The geological structure of the mine lots, are represented by the faults related to volcanic arcs, created out of 4 volcanic arcs made by the eastward subduction of the Maluku Sea microplate beneath the Halmahera plate, after the Neogene period.

The gold mine of NHM largely displays the N30˚~40˚W and almost NS-directed faults and the mineralization generally has occurred along the NS-directed faults. Similarly, the gold mine of PT. ORO KNI chiefly shows the N30˚~80˚W-directed faults. The strikes of these faults are analogous to the dominant lineational analysis, except for the NS-directed ones.

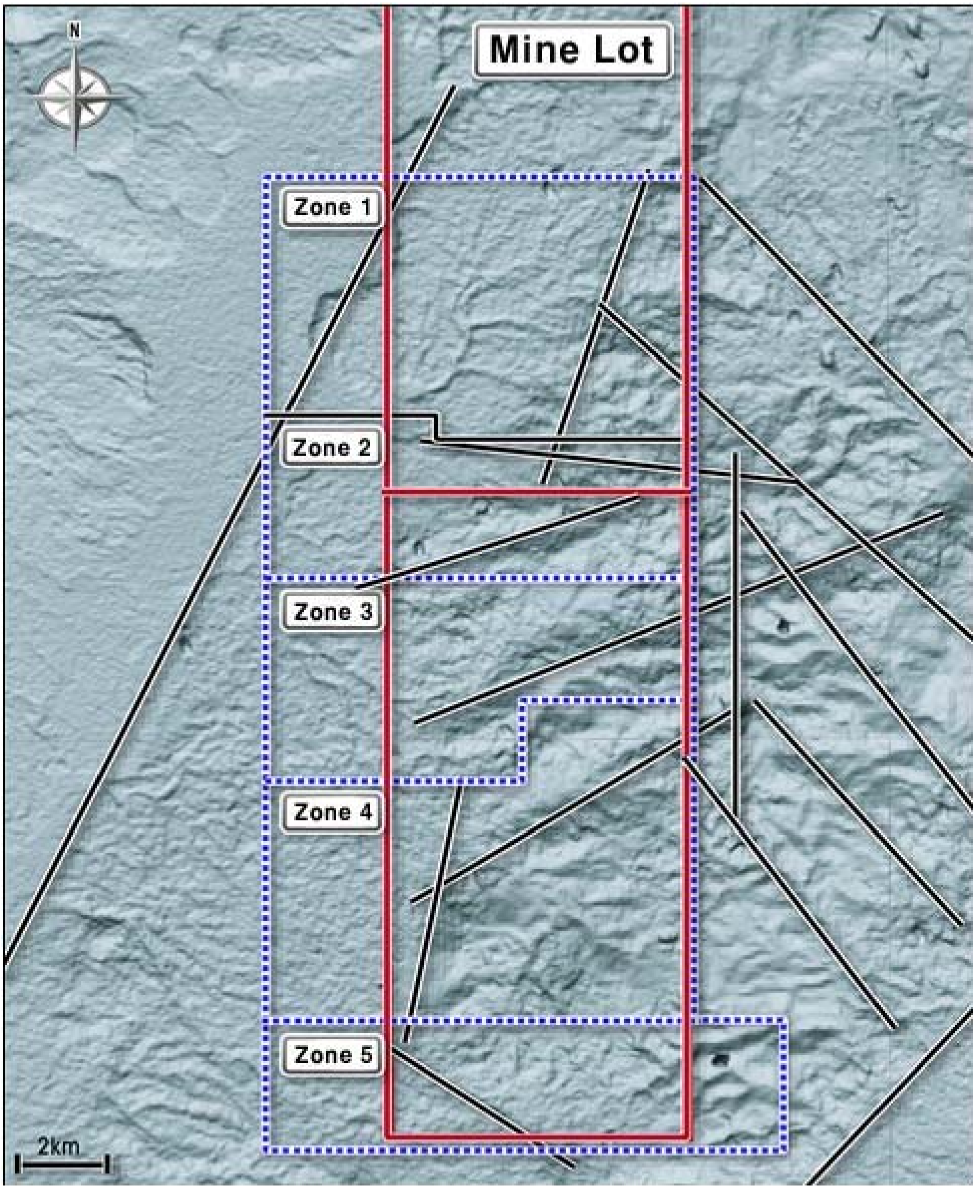


Figure 5-5 Lineal Structure of Survey Zones

6. SURVEY METHOD

6.1 Regional Geological Survey

6.1.1 Regional Geochemical Survey

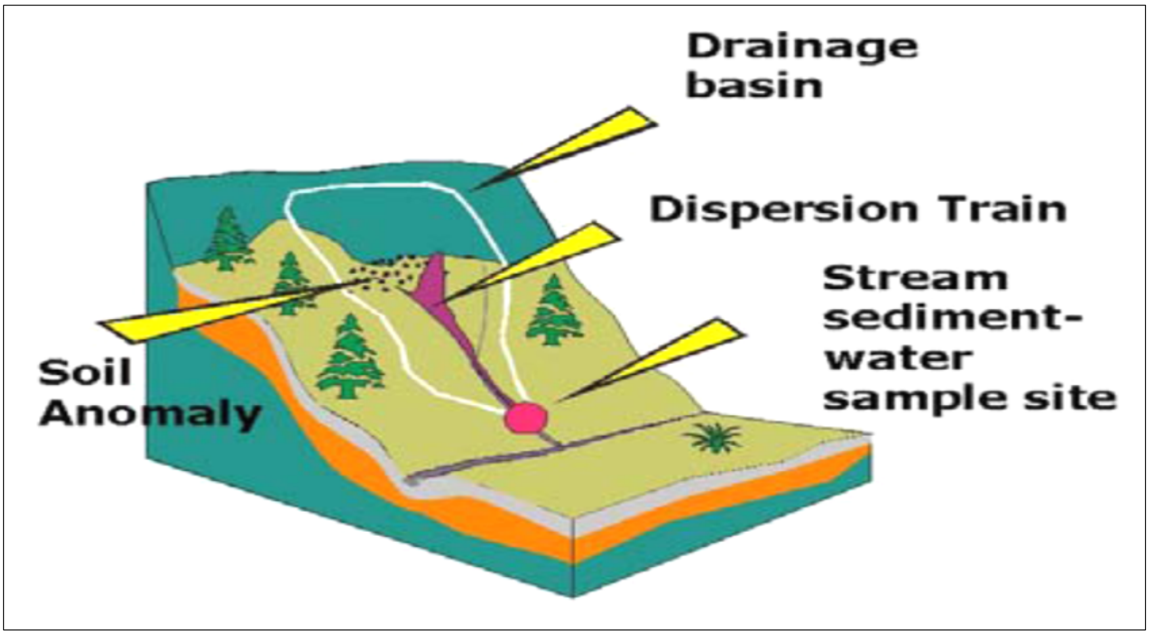


Figure 6-1 Mimetic Diagram of Geochemical Anomaly Zone in Drainage System

○ **Stream Sediment Sampling**

A. In a regional geochemical survey, stream sediments in the 1st and 2nd water system are weathered rocks in the catchment basin of upstream or gathered particles, resulted from soil, moving through the water system. The sediments are considered as a representative geological medium fully reflecting the surface and geological environment and therefore by the sediments, geological features and trace elements in the nearby region might be understood.

As shown in Figure 6-1, a series of moving process by material of wall rock is viewed as geochemical dispersion and elements from this dispersion are redistributed, fractionated, and mixed.

According to the backward tracing on the dispersed elements, basic geological data, including types and shapes of rocks and the existence of mineralized and alteration zones of wall rock are obtained. This basic geological data can lead to the mineralized areas[1].

In this survey, the same survey method of the adjacent NHM gold mine was applied.[2]

B. Regarding the sampling density, 1 sample per 1㎢ was collected on average, according to the geological survey manual, published at the Geological Survey in Malaysia. In this manual, 1 sample per 1.7㎢ is collected in a tropical rainforest region.[3]

C. Samples are chiefly collected at riverbeds where sedimentation is finished or underway in the stream confluence and 20ℓ wet sandsilt, passed through a 10mesh(2mm) sieve, is acquired.

D. This sandsilt is passed through a 80mesh(0.177mm) sieve and is put into a plastic zipper bag and then, is naturally dried for analysis (Photo 6-1).

1) Hyo Taek Jeon et al., 1993, Applied Geochemistry, Seoul National University Press
2) G.R. Davey et al., 1997, Discovery of the Gosowong Epithermal Quartz-Adularia Vein Gold Deposit
3) Fateh Chand et al., 1981, A Manual of Chemical of Exploration Methods, pp.2:1-2:22, Geological Survey Malaysia

① Selecting Sampling Location

② Sieving 1 – Collecting a 20ℓ uniform sample by using a 10mesh(2.0㎜) sieve

③ Sieving 2 – Collecting samples by using a 80mesh(0.177mm) sieve

④ Collecting Samples

Photo 6-1 Stream Sediment Sampling

○ **Heavy Mineral Stream Concentrate Sampling**

A. A sample, unable to pass through a 80mesh(0.177mm) sieve, is separately gathered and panned. Then, alluvial gold particles, out of remaining heavy minerals in the pan, are observed(Photo 6-2).

B. Sediment(20ℓ) at the potential spot is collected and panned. Then, alluvial gold particles, out of remaining heavy minerals in the pan, are checked.

C. The number of alluvial gold particles are written down. Then, samples are put into a plastic zipper bag and are naturally dried for analysis.

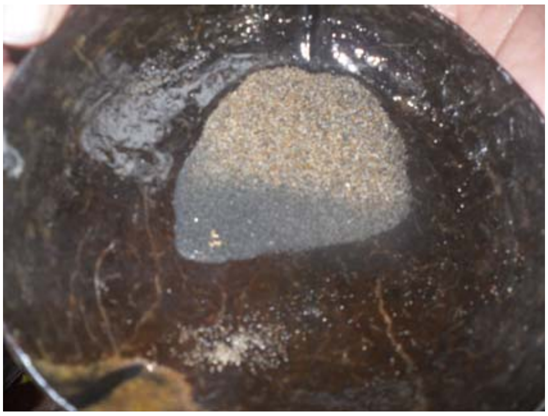



Photo 6-2 Panning(left) and Heavy Mineral Stream Concentrate Sample(right)

○ **Float Rock Sampling**

If gold ores or other useful metal minerals and gravels, having the potential resulted from an alteration zone, are discovered along a stream, they are collected(less than 3kg), put in a plastic zipper bag, and then sent to the lab for analysis.

6.1.2 Basic Surface Geological Survey

○ **Survey Method**

A. When the regional geochemical survey is conducted along a stream, the location and level of discovered rock outcrops are identified by GPS(Global Positioning System). The strike and dip of rock outcrops are measured through a clinometer, too.

B. The survey was also carried out along ridges and slopes so as to check the geological boundaries and the length of outcrops.

C. If they turn out to be mineral outcrops, their scope is checked with a tapeline. In addition, the field names of rock outcrops are confirmed through a hammer and loupe before sampling.

D. Geological structures such as faults and folds are observed and recorded.

○ **Ore Sampling**

A. A fresh part of representative rock outcrops is hit by a hammer and a sample less than 3kg is collected. And then, the sample is put in a plastic zipper bag and sent to Korea for thin section production. This thin section is observed by polarization microscope and types of rocks and minerals are fully checked through an X-Ray Diffraction(XRD) analysis.

B. A surveyor goes along the expected vertical direction of outcrops of ore bodies or mineralized zones. When he or she finds a spot with a more clearly exposed outcrop at the interval of 30m, if possible, he or she hits the spot at the horizontal interval of 0.3～1m and collects an adequate amount of sample. Then, a composite sample less than 3kg is made, put in a plastic zipper bag and sent to the lab for analysis.

6.2 Detailed Geological Survey

6.2.1 Detailed Geochemical Survey

○ **Soil Sampling**

A. Soil samples are influenced by the chemical and mineralogical characteristics of parent material. A weathered residue presents a very direct and clear geochemical guide. For instance, the first residue mineral plays a role of an indicator for wall rock since it includes the second minerals produced by weathering and dissolvable substances, transported by circulated water.

B. Sampling was done from the B layer in the soil section. As displayed in Figure 6-2, the B layer, situated below the A layer, is regarded as an illuvial horizon since several materials are separated and leached chemicophysically from the top and deposited or accumulated below. In addition, clay, iron oxide, aluminium, and corrosive substances are accumulated in this B layer and thus it takes on darker reddish brown, yellowish brown, and dark gray along with a relatively more distinct structure and concentrated microelements. For this, it is a target for a geochemical survey[1).

C. Soil sampling spots are laid out in a grid net at the interval of 100m along a vertical baseline and at the interval of 50m along a horizontal sideline, considering Au anomaly points and surface slopes.

D. Surface soil(O, A, and E layer; around 60cm distant from the surface) are removed by a shovel or trowel from the sampling spots.

E. Then, about a 200～500g sample is obtained by an auger for analysis(Figure 6-2).

F. For a post review, location and sample number are marked on a red ribbon, tied to a tree.

G. The collected sample is put into a plastic zipper bag and moved to the base camp at the mine field. Then, it is naturally dried and sent to the lab for analysis.

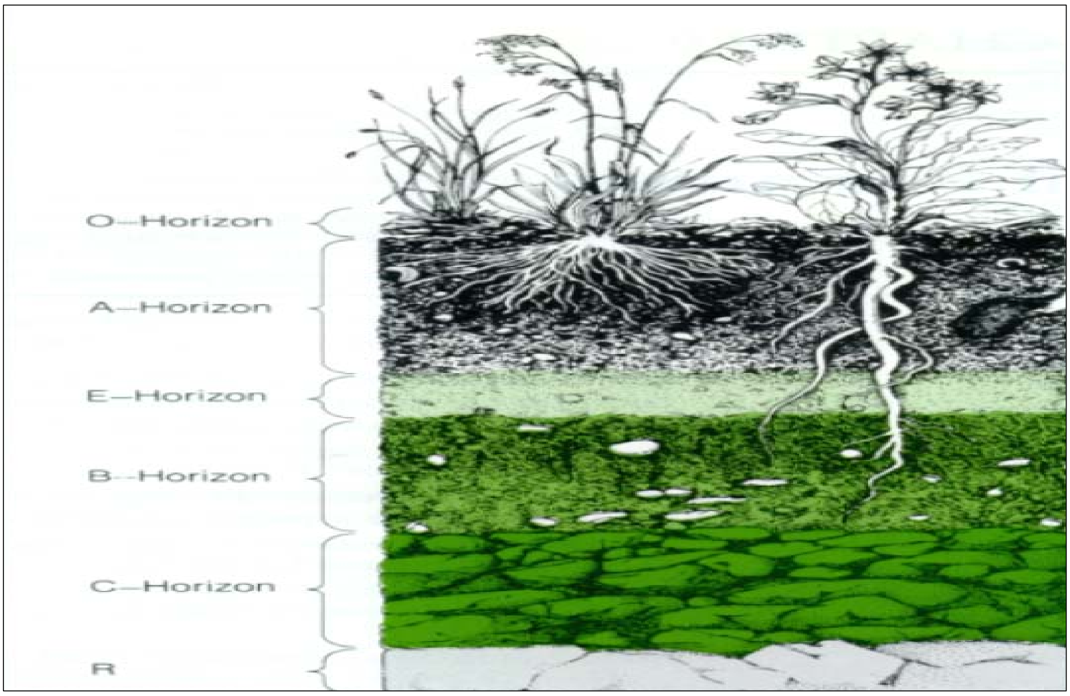


Figure 6-2 Categorization of Soil Layers

1) Hyo Taek Jeon et al., 1993, Applied Geochemistry, Seoul National University Press

① Removing Layer by Shovel

② Sampling from B Layer by Auger

③ Sampling from B Layer

④ Putting Sample in Plastic Zipper Bag

Photo 6-3 Soil Sampling

6.2.2 Detailed Surface Geological Survey

○ **Survey Method**

A. The most effective method here is a simplified survey, because the gold mine is overlaid with tropical forests and hence it is very difficult to apprehend the exact geological coordinates, height, and location, solely utilizing GPS. A route map is drawn from the simplified survey.

B. Tools, such as GPS, clinometer, altimeter, geological hammer, loupe and waterproof field book, are necessary for the simplified survey.

C. After fixing a base point to determine geological coordinates and location on a map through GPS, the base point is marked on the map. A direction is determined by a clinometer along a pre-planned route. Then, a leading surveyor with a tapeline moves forward around 50m along the direction and stops for choosing the first way point on GPS.

D. A surveyor measures and writes down the coordinates and level of the base point and the surface slope of direction and route. If outcrops are discovered, a geological situation including the rock names and the strike and dip of faults are recorded in a field book. If necessary, a sample is collected. Once he or she reaches to the first way point on GPS, the related job process is repeated.

E. A basic geological map is drawn and a survey result is written down on a squared paper in detail at the base camp on a daily basis.

○ **Ore Sampling**

The same method for a basic surface geological survey is utilized.

6.3 Sample Analysis Method

○ Samples collected from the survey region are 513 in all. In specific, there are 116 for stream sediments, 15 for float rocks, 66 for ores, 8 for heavy mineral stream concentrates, 298 for soil, 3 for clay, 5 for microscopic examination, and 2 for XRD analysis.

○ Except for 7 samples transported to Korea, the remaining 506 collected samples were analyzed at PT. Intertek Utama Services, professional mineral analysis company, located in Jakarta, Indonesia.

○ The analysis method of this company is fire assay. According to types of samples, Atomic Absorption Spectrometer(AAS), Cold Vapor

Atomic Absorption Spectrophotometry(CVAAS), and X-Ray Fluorescence Analyzer(XFA) are also used.

- Out of 144 samples in total, 129 soil samples from Donghar area in Zone 3, 3 stream sediment samples in Zone 4, and 12 stream sediment samples in Zone 5, are analyzed just for 3 elements such as Au, Ag, and Cu. Au was analyzed in ppb and ppm, and Ag and Cu were in ppm. The remaining 362 samples were analyzed for 7 elements such as Au, Ag, As, Cu, Mn, Hg, and Sb in ppm.

7. REGIONAL GEOLOGICAL SURVEY

7.1 Regional Geochemical Survey

7.1.1 Overview

Based on the development of water system along with accessibility and convenience, a regional geological survey was performed by dividing the survey region into 5 Zones. Particularly, in a regional geochemical survey, heavy mineral stream concentrate, stream sediment, and float rock samples were collected along the stream.

Among these samples, stream sediment samples were collected chiefly near the confluence of water system. Au analysis values of these samples along with heavy mineral stream concentrate samples can play a role in narrowing down the scope of mineralization.

After panning the remaining stream sediments, heavy mineral stream concentrate samples were collected and their number of gold particles were written down. Also, float rocks with the potential of ores or mineralized zones were analyzed.

In general, in case there is a single rock is distributed in the survey region, a threshold of target element in the rock is used as an anomaly standard[1)]. Several elements are mixed in the stream sediments and thus an average, standard deviation, and maximum threshold are obtained and then the maximum threshold is set as an anomaly standard. Nonetheless, Au 0.05ppm was set as an anomaly standard in this survey, considering the fact that the nearby NHM's mine, having similar geological conditions and deposits with PT. ORO KNI's mine, established and confirmed Au 0.05ppm as an anomaly standard.

Concerning heavy mineral stream concentrate samples, 3 alluvial gold particles were established as an anomaly standard in this survey. This

1) In Joon Kim et. al., 2004, Soil Geochemical Exploration of the Mt. Subang Area of the Southern Part of the Bandung, Indonesia, Economic and Environmental Geology, vol. 37, pp.173-184

anomaly standard was resulted from an arithmetic mean of the observed gold particles in the related samples, 2.7. In this survey, 1～5 alluvial gold particles were observed in 9 samples.

In case of float rock and ore samples, Au 2.0ppm was set as an anomaly standard, since Au 2.0g/t is set as “Standard for Gold Exploration Permit” in “Operational Guidelines in Mining Business” provided by the Ministry of Trade, Industry, and Energy(MOTIE; former the Ministry of Knowledge Economy, MKE) in Korea.

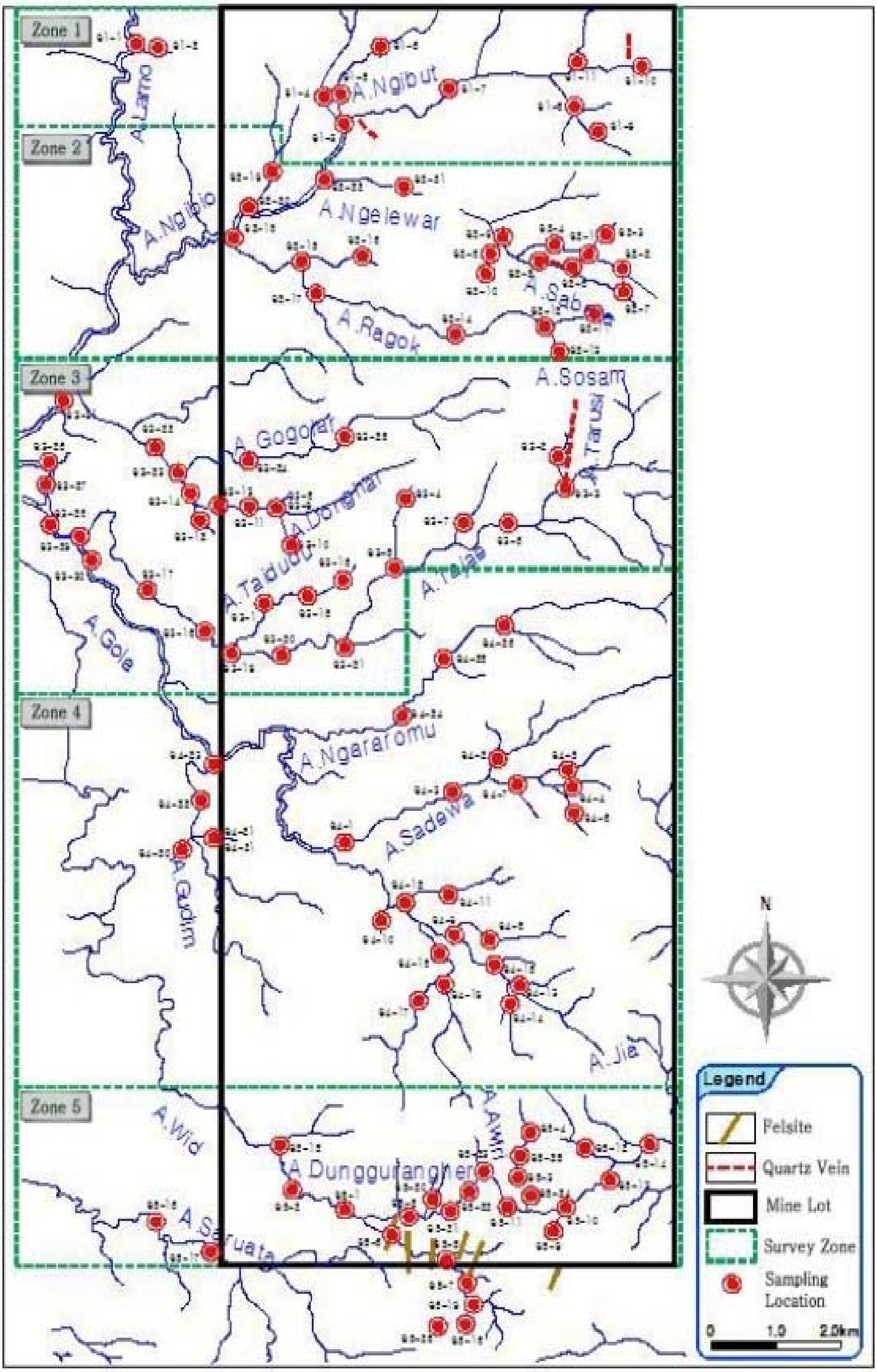


Figure 7-1 Sampling Location of Stream Sediments

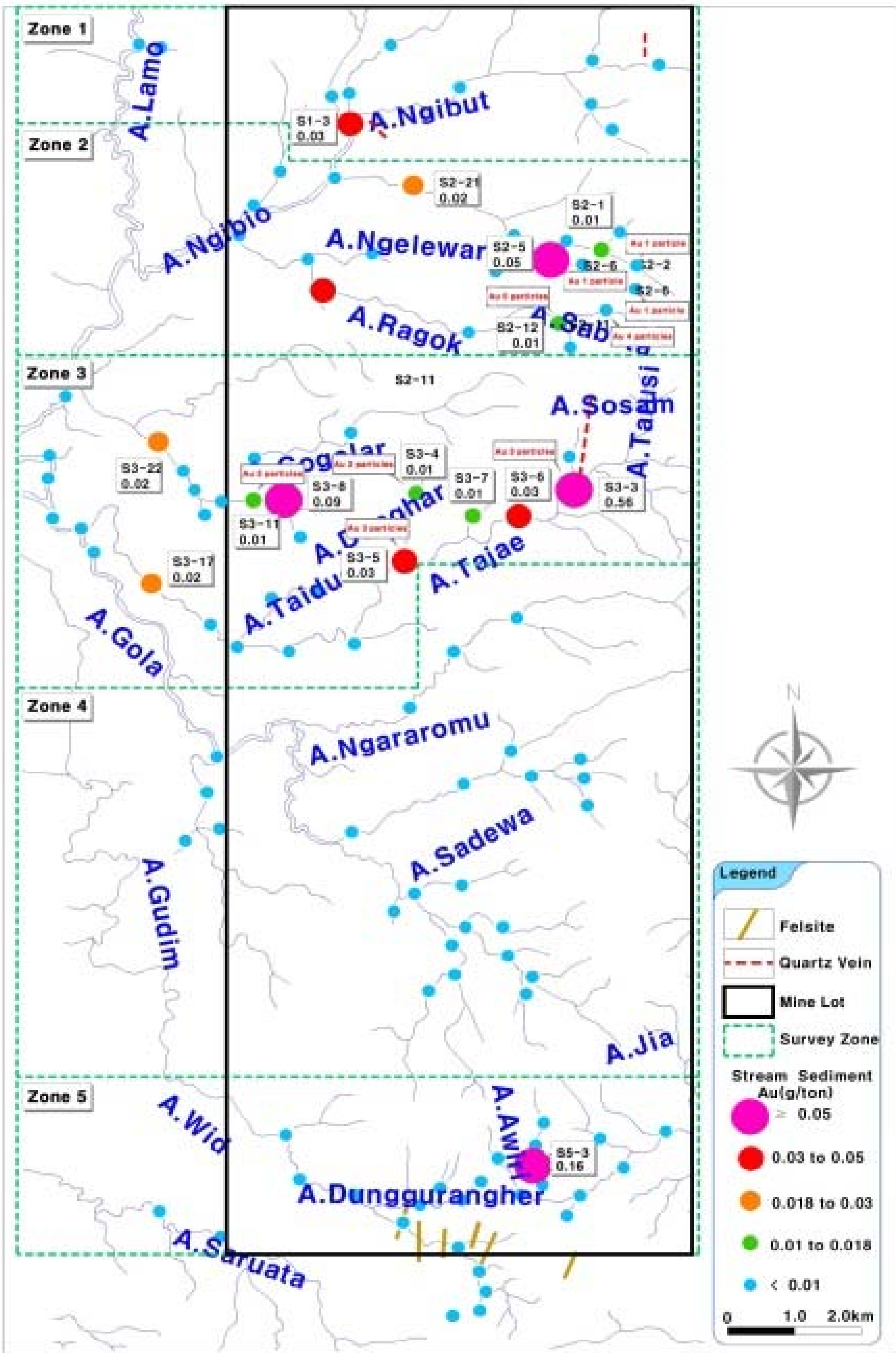


Figure 7-2 Analysis Result of Stream Sediment(SS) and Heavy Mineral Stream Concentrate(HMSC) Samples

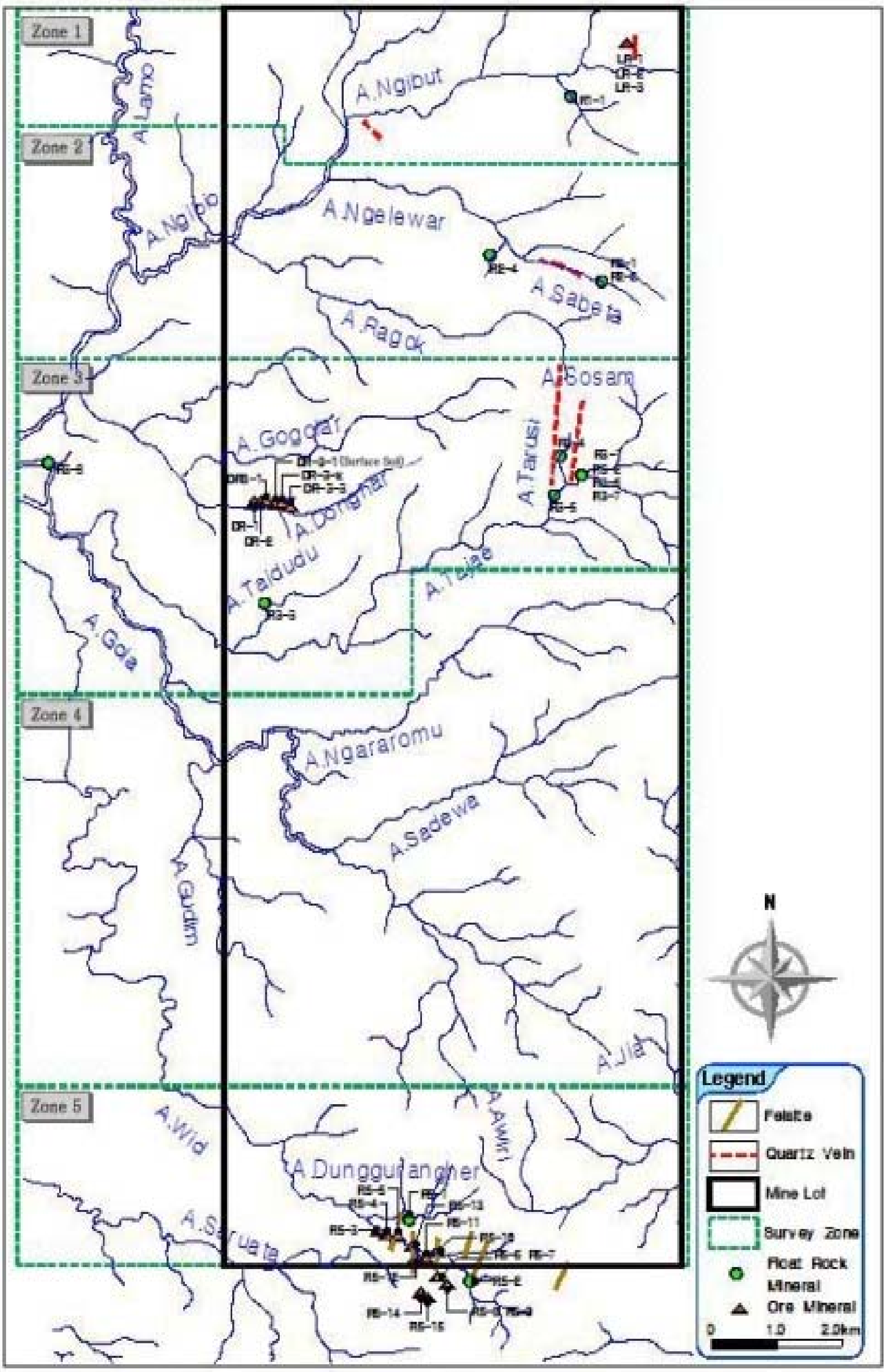


Figure 7-3 Sampling Location of Float Rock and Ore Samples

7.1.2 Result

○ **Zone 1**

The total number of stream sediment samples was 11, inclusive of 2 for Lamo river and its tributary, 5 for Ngibut stream, and 4 for other tributaries(Figure 7-1).

The analysis result of stream sediments indicated that Au 0.03ppm was detected at S1-3 spot in the downstream of Ngibut stream, but this is not enough to meet the Au anomaly standard. Although there is a nearby alteration zone, one cannot be sure about its connection with the mineralizaiton at S1-3 spot. Other samples were produced less than Au 0.01ppm(Figure 7-2 and Table 7-1).

In regards to the heavy mineral stream concentrate samples, alluvial gold particles were not found.

In the up and midstream of Ngibut stream, float rock samples were collected from the quartz vein at R-1 spot. Sulfide metal minerals such as pyrite, copper pyrite, and enargite were discovered(Figure 7-3 and Photo 7-1). These samples produced Au 0.05ppm. Samples were also collected in the upstream, but any development of ore vein could not be detected due to a waterfall. According to the relevant analysis, there is a strong possibility of mineralized outcrops in the upstream watershed where float rock samples were collected(Table 7-2).

Table 7-1 Analysis Result of Stream Sediment Samples(Zone 1; unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb	Coordinates	
									N	E
S1-1	1-1	<0.01	NA	<1	NA	NA	NA	NA	1° 15′ 37.0″	127° 33′ 31.6″
S1-2	1-2	<0.01	NA	<1	NA	NA	NA	NA	1° 15′ 35.1″	127° 33′ 42.3″
S1-3	1-3	0.03	NA	<1	NA	NA	NA	NA	1° 14′ 56.9″	127° 35′ 13.1″
S1-4	1-4	<0.01	NA	<1	NA	NA	NA	NA	1° 15′ 10.6″	127° 35′ 05.5″
S1-5	1-5	<0.01	NA	<1	NA	NA	NA	NA	1° 15′ 11.8″	127° 35′ 12.7″
S1-6	1-6	<0.01	NA	<1	NA	NA	NA	NA	1° 15′ 14.7″	127° 36′ 32.5″
S1-7	1-7	<0.01	NA	<1	NA	NA	NA	NA	1° 15′ 06.5″	127° 36′ 05.6″
S1-8	1-8	<0.01	NA	<1	NA	NA	NA	NA	1° 15′ 26.5″	127° 37′ 08.9″
S1-9	1-9	<0.01	NA	<1	NA	NA	NA	NA	1° 15′ 26.5″	127° 37′ 19.5″
S1-10	1-10	<0.01	NA	<1	NA	NA	NA	NA	1° 15′ 28.6″	127° 37′ 41.6″
S1-11	1-11	<0.01	NA	<1	NA	NA	NA	NA	1° 15′ 37.1″	127° 37′ 10.1″

Table 7-2 Analysis Result of Float Rock Samples(Zone 1; unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb
R1-1	K-1-1	0.05	188	<1	349	0.07	9	3

Photo 7-1 Float Rock Sample of Quartz Vein

○ **Zone 2**

The total number of stream sediment samples was 22, including 3 for Sabeta stream, where ore veins were previously detected, 3 for Sabeta Kecil stream, 7 for Ngelewar stream, 3 for Sosam stream, and 6 for other tributaries(Figure 7-1).

The analysis of stream sediments showed that Au 0.05ppm was found at S2-5 spot of Sabeta stream where a gold-bearing quartz vein(width: 70m) starts. Additionally, Au 0.03ppm at S2-17 spot(lower Sosam stream) and Au 0.02ppm at S2-21 spot(lower Ngelewar stream) were found. Other stream sediment samples displayed that Au 0.01ppm or less than 0.01ppm(Figure 7-2 and Table 7-3).

According to the Figure 7-2, regarding the panned heavy mineral stream concentrate samples, 1 alluvial gold particle was observed respectively at S2-2 spot(Ngelewar stream) and S2-6 & S2-7 spot(Sabeta stream). Also, 4 and 5 alluvial gold particles were detected each at S2-11 and S2-12 spot(Sosam stream).

Based on the analysis of heavy mineral stream concentrate samples, Au 92.3ppm(4 alluvial gold particles) at S2-11 spot along with 5 alluvial gold particles at S2-12 spot were discovered. This suggests there is a gold-bearing ore body or gold mineralized zone in the upstream of sampling locations(Table 7-4).

Nonetheless, float rock samples at R2-1 and R2-2 spot(Sabeta stream) contained less than Au 0.01ppm and 0.01ppm, respectively. In addition, R2-3 spot(Sosam stream) produced less than Au 0.01ppm and there were not sufficient samples for analysis at R2-4 spot(Sabeta Kecil stream) in Figure 7-3 and Table 7-5.

Table 7-3 Analysis Result of Stream Sediment Samples(Zone 2; unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb	Coordinates	
									N	E
S2-1	2-1	0.01	NA	<1	NA	NA	NA	NA	1° 13′ 52.4″	127° 37′ 14.6″
S2-2	2-2	<0.01	NA	<1	NA	NA	NA	NA	1° 13′ 45.1″	127° 37′ 32.4″
S2-3	2-3	<0.01	NA	<1	NA	NA	NA	NA	1° 14′ 00.7″	127° 37′ 22.9″
S2-4	2-4	<0.01	NA	<1	NA	NA	NA	NA	1° 13′ 58.1″	127° 36′ 57.5″
S2-5	2-5	0.05	NA	<1	NA	NA	NA	NA	1° 13′ 48.5″	127° 36′ 49.8″
S2-6	2-6	<0.01	NA	<1	NA	NA	NA	NA	1° 13′ 44.3″	127° 37′ 05.1″
S2-7	2-7	<0.01	NA	<1	NA	NA	NA	NA	1° 13′ 32.4″	127° 37′ 30.9″
S2-8	2-8	<0.01	NA	<1	NA	NA	NA	NA	1° 13′ 51.6″	127° 36′ 26.4″
S2-9	2-9	<0.01	NA	<1	NA	NA	NA	NA	1° 13′ 58.8″	127° 36′ 32.1″
S2-10	2-10	<0.01	NA	<1	NA	NA	NA	NA	1° 13′ 42.0″	127° 36′ 23.1″
S2-11	2-11	<0.01	NA	<1	NA	NA	NA	NA	1° 13′ 21.2″	127° 37′ 17.2″
S2-12	2-12	0.01	NA	<1	NA	NA	NA	NA	1° 13′ 17.0″	127° 36′ 53.9″
S2-13	2-13	<0.01	NA	<1	NA	NA	NA	NA	1° 12′ 58.4″	127° 37′ 01.1″
S2-14	2-14	<0.01	NA	<1	NA	NA	NA	NA	1° 13′ 11.0″	127° 36′ 10.0″
S2-15	2-15	<0.01	NA	<1	NA	NA	NA	NA	1° 13′ 48.3″	127° 34′ 53.0″
S2-16	2-16	<0.01	NA	<1	NA	NA	NA	NA	1° 13′ 51.1″	127° 35′ 23.6″
S2-17	2-17	0.03	NA	<1	NA	NA	NA	NA	1° 13′ 32.6″	127° 35′ 02.3″
S2-18	2-18	<0.01	NA	<1	NA	NA	NA	NA	1° 13′ 59.0″	127° 34′ 18.6″
S2-19	2-19	<0.01	NA	<1	NA	NA	NA	NA	1° 14′ 33.2″	127° 34′ 39.2″
S2-20	2-20	<0.01	NA	<1	NA	NA	NA	NA	1° 14′ 14.6″	127° 34′ 28.3″
S2-21	2-21	0.02	NA	<1	NA	NA	NA	NA	1° 14′ 24.6″	127° 35′ 44.2″
S2-22	2-22	<0.01	NA	<1	NA	NA	NA	NA	1° 14′ 30.2″	127° 35′ 05.6″

Table 7-4 Analysis Result of Heavy Mineral Stream Concentrate Samples(Zone 2; unit: ppm)

Location No.	Sample No.	Au	Ag	No. of Alluvial Au Particles	Name of Stream
S2-2	2-2-1	0.45	<1	1	Ngelewar
S2-6	2-6-1	0.02	4	1	Sabeta
S2-7	2-7-1	0.07	<1	1	Sabeta
S2-11	2-11-1	92.3	4	4	Sosam
S2-12	-	-	-	5	Sosam

Table 7-5 Result Analysis of Float Rock Samples(Zone 2; unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb
R2-1	K-2-1	<0.01	25	<1	536	0.04	5	3
R2-2	K-2-2	0.01	48	<1	423	0.09	9	2
R2-3	K-2-3	<0.01	54	<1	375	0.02	18	1
R2-4	K-2-4	IS	502	20	374	0.04	IS	IS

○ Zone 3

The total number of stream sediment samples was 31 inclusive of 8 for Tajae stream, 2 for Tarusi stream, 9 for Donghar stream, 2 for Gogolar stream, 5 for Gola stream, 3 for Taidudu stream, and 2 for other tributaries(Figure 7-1).

Concerning the stream sediment samples, Au 0.56ppm at S3-3 spot(Tarusi stream; the highest Au content among all stream sediment samples and over 10 times higher than the Au anomaly standard), Au 0.03ppm at S3-6 spot(mid Tajae stream), Au 0.03ppm at S3-5 spot(upper and mid Tajae stream), and Au 0.02ppm at S3-17 spot(lower Tajae stream) were obtained respectively.

The analysis result of stream sediment samples in Donghar stream showed that relatively high Au 0.09ppm at S3-8 spot near a hot spring and Au 0.02ppm at S3-22 spot. In case of other stream sediment samples, Au 0.01ppm or less than 0.01ppm was observed(Figure 7-2 and Table 7-6).

Mostly, at least 1 alluvial gold particle was observed from the heavy mineral stream concentrate samples in Tarusi stream, including 5 particles at S3-3 spot(Tarusi stream), and 1 particle at S3-2 spot. Also, 3 particles at S3-5 spot(Tajae stream) and 4 particles at S3-11 spot(Donghar stream) were found(Figure 7-2).

In addition, Au content was checked by analyzing the samples from S3-2 & S3-3 spot(Tarusi stream) and S3-5 & S3-11 spot(Donghar stream). According to the analysis result, Au 337ppm(S3-3 spot), 0.2ppm(S3-2 spot), 36.3ppm(S3-5 spot), and 145ppm(S3-11 spot) were found(Table 7-7).

The analysis result of 8 float rock samples in this zone, Au content turned out to be 0.52ppm at R3-1 spot(Tarusi stream) and less than Au 0.01ppm at other samples(Figure 7-3 and Table 7-8).

Based on the analysis of stream sediment samples at Tarusi stream, Au 0.56ppm was found at S3-3 spot, over 10 times higher than the Au anomaly standard. This, coupled with 5 alluvial gold particles from heavy mineral stream concentrate samples, strongly suggests the existence of a gold-bearing quartz vein at the watershed in Tarusi area.

In regards to the stream sediment samples in Donghar stream, high Au content(0.09ppm) was recorded at S3-8 spot, near the hot spring in its midstream and in terms of heavy mineral stream concentrate samples, 4 alluvial gold particles were checked at S3-11 spot in the downstream. This also indicates that the existence of a gold-bearing quartz vein at the watershed in the mid Donghar stream.

Table 7-6 Analysis Result of Stream Sediment Samples(Zone 3; unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb	Coordinates	
									N	E
S3-1	3-1-2	<0.01	42	<1	1300	IS	IS	IS	1° 10′ 54.7″	127° 34′ 35.2″
S3-2	3-2-2	<0.01	48	<1	1120	IS	IS	IS	1° 12′ 09.3″	127° 37′ 00.1″
S3-3	3-3	0.56	60	<1	996	0.12	3	2	1° 11′ 49.6″	127° 36′ 56.8″
S3-4	3-4-2	0.01	82	<1	1290	0.04	5	<1	1° 11′ 47.3″	127° 35′ 44.6″
S3-5	GPS13	0.03	75	<1	1090	0.09	5	<1	1° 11′ 12.0″	127° 35′ 38.9″
S3-6	3-6	0.03	49	<1	856	0.09	4	2	1° 11′ 35.5″	127° 36′ 34.7″
S3-7	3-7	0.01	70	<1	964	0.07	IS	IS	1° 11′ 35.4″	127° 36′ 12.4″
S3-8	3-8	0.09	124	<1	912	0.08	2	1	1° 11′ 44.3″	127° 34′ 39.2″
S3-9	3-9	<0.01	51	<1	1300	0.03	4	1	1° 11′ 24.5″	127° 34′ 48.5″
S3-10	3-10-2	<0.01	65	<1	595	0.03	13	<1	1° 11′ 44.3″	127° 34′ 39.2″
S3-11	3-11-2	0.01	47	<1	1210	0.04	12	<1	1° 11′ 42.9″	127° 34′ 27.1″
S3-12	3-12-2	<0.01	35	<1	2940	<0.01	16	<1	1° 11′ 37.4″	127° 34′ 03.3″
S3-13	3-13-2	<0.01	23	<1	2470	IS	IS	IS	1° 11′ 44.2″	127° 34′ 11.0″
S3-14	3-14-2	<0.01	37	<1	1530	IS	IS	IS	1° 11′ 50.1″	127° 33′ 58.1″
S3-15	3-15-2	<0.01	53	<1	1140	0.21	22	<1	1° 10′ 58.7″	127° 34′ 56.7″
S3-16	3-16-2	<0.01	73	<1	1040	IS	IS	IS	1° 11′ 06.4″	127° 37′ 00.1″
S3-17	3-17-2	0.02	60	<1	1050	0.02	7	2	1° 11′ 00.2″	127° 33′ 37.8″
S3-18	3-18-2	<0.01	67	<1	1100	0.05	6	<1	1° 10′ 40.9″	127° 34′ 06.1″
S3-19	3-2P-2	<0.01	58	<1	893	0.01	IS	IS	1° 10′ 29.6″	127° 34′ 18.7″
S3-20	3-20-2	<0.01	78	<1	1410	IS	IS	IS	1° 10′ 27.8″	127° 34′ 43.8″
S3-21	3-21-2	<0.01	75	<1	1360	IS	IS	IS	1° 10′ 31.6″	127° 35′ 14.9″
S3-22	3-22	0.02	46	<1	1940	0.03	IS	IS	1° 12′ 14.2″	127° 33′ 41.3″
S3-23	3-23	<0.01	43	<1	1060	0.03	5	1	1° 12′ 00.0″	127° 33′ 52.6″
S3-24	3-24-2	<0.01	31	<1	1470	0.02	8	2	1° 12′ 06.3″	127° 34′ 27.2″
S3-25	3-25-2	<0.01	57	<1	1240	0.03	12	2	1° 12′ 19.3″	127° 35′ 13.2″
S3-26	3-26-2	<0.01	48	<1	910	IS	IS	IS	1° 12′ 07.8″	127° 32′ 47.0″
S3-27	3-27	<0.01	50	<1	957	0.04	6	<1	1° 11′ 56.3″	127° 32′ 48.9″
S3-28	3-28-3	<0.01	21	<1	1990	<0.01	3	<1	1° 11′ 33.8″	127° 32′ 49.8″
S3-29	3-29	<0.01	21	<1	1180	0.02	2	<1	1° 11′ 28.1″	127° 33′ 03.5″
S3-30	3-30	<0.01	31	<1	1690	0.02	1	<1	1° 11′ 16.3″	127° 33′ 10.4″
S3-31	3-31-2	<0.01	27	<1	2000	0.02	8	<1	1° 12′ 48.5″	127° 33′ 03.7″

Table 7-7 Analysis Result of Heavy Mineral Stream Concentrate Samples(Zone 3; unit: ppm)

Location No.	Sample No.	Au	Ag	No. of Alluvial Au Particles	Name of Stream
S3-2	3-2-1	0.2	<1	1	Tarusi
S3-3	3-3-1	337	39	5	Tarusi
S3-5	GPS-7	36.3	<1	3	Tajae
S3-11	GPS-9	145	1	4	Donghar

Table 7-8 Analysis Result of Float Rock Samples(Zone 3; unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb
R3-1	5-3-1	0.52	87	<1	462	<0.01	2	3
R3-2	5-3-2	<0.01	97	<1	354	0.02	3	<1
R3-3	5-3-3	<0.01	16	<1	131	1.18	44	2
R3-4	5-3-4	<0.01	183	<1	259	0.86	161	<1
R3-5	5-3-5	<0.01	39	<1	34	0.33	13	3
R3-6	5-3-6	<0.01	1400	<1	26	<0.01	361	5
R3-7	5-3-7	<0.01	39	<1	93	<0.01	35	3
R3-8	5-3-8	<0.01	289	<1	88	0.06	26	1

○ Zone 4

A total of 26 stream sediment samples were collected in this zone including 11 for the upper tributary of Gola stream, 7 for Sadewa stream, 5 for Gudim stream, and 3 for Ngararomu stream(Figure 7-1).

These samples produced less than Au 0.01ppm(Figure 7-2 and Table 7-9). There was no alluvial gold particle in the panned heavy mineral stream concentrate samples. This hints a fat chance for a gold ore body or mineralized zone.

Table 7-9 Analysis Result of Stream Sediment Samples(Zone 4; unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb	Coordinates	
									N	E
S4-1	4-1	<0.01	89	<1	1440	0.02	3	<1	1° 8′ 54.3″	127° 35′ 14.7″
S4-2	4-2	<0.01	NA	<1	NA	NA	NA	NA	1° 9′ 36.6″	127° 36′ 29.9″
S4-3	4-3	<0.01	109	<1	1760	0.02	<1	<1	1° 9′ 19.8″	127° 36′ 07.2″
S4-4	4-4	<0.01	117	<1	1730	0.02	4	<1	1° 9′ 22.6″	127° 37′ 05.3″
S4-5	4-5	<0.01	86	<1	1300	0.02	<1	<1	1° 9′ 29.9″	127° 37′ 04.0″
S4-6	4-6	<0.01	68	<1	1330	0.04	6	<1	1° 9′ 08.8″	127° 37′ 07.0″
S4-7	4-7	<0.01	56	<1	1060	0.03	4	<1	1° 9′ 22.3″	127° 36′ 41.1″
S4-8	4-8	<0.01	56	<1	1340	0.03	5	<1	1° 8′ 04.3″	127° 36′ 26.8″
S4-9	4-9	<0.01	58	<1	1320	0.05	9	1	1° 8′ 04.9″	127° 36′ 08.0″
S4-10	4-10	<0.01	49	<1	1400	0.05	7	<1	1° 8′ 14.1″	127° 35′ 34.1″
S4-11	4-11	<0.01	70	<1	1590	0.04	6	<1	1° 8′ 27.7″	127° 36′ 06.1″
S4-12	4-12	<0.01	68	<1	1540	0.04	9	2	1° 8′ 20.7″	127° 35′ 45.5″
S4-13	4-13	<0.01	61	<1	1540	0.04	6	<1	1° 7′ 39.5″	127° 36′ 39.8″
S4-14	4-14	<0.01	NA	<1	NA	NA	NA	NA	1° 7′ 32.0″	127° 36′ 37.4″
S4-15	4-15	<0.01	NA	<1	NA	NA	NA	NA	1° 7′ 51.2″	127° 36′ 27.5″
S4-17	4-17	<0.01	NA	<1	NA	NA	NA	NA	1° 7′ 33.5″	127° 35′ 50.9″
S4-18	4-18	<0.01	47	<1	1060	0.04	7	<1	1° 7′ 57.1″	127° 36′ 01.7″
S4-19	4-19	<0.01	NA	<1	NA	NA	NA	NA	1° 7′ 38.5″	127° 35′ 05.3″
S4-20	4-20	<0.01	NA	<1	NA	NA	NA	NA	1° 8′ 55.4″	127° 33′ 55.7″
S4-21	4-21	<0.01	28	<1	1710	0.02	5	<1	1° 8′ 57.9″	127° 34′ 04.1″
S4-21	4-21	<0.01	NA	<1	NA	NA	NA	NA	1° 8′ 57.9″	127° 34′ 04.1″
S4-22	4-22	<0.01	NA	<1	NA	NA	NA	NA	1° 9′ 15.1″	127° 34′ 04.0″
S4-23	4-23	<0.01	19	<1	2120	<0.01	1	<1	1° 9′ 29.8″	127° 34′ 08.5″
S4-24	4-A-1	0.002	80	<1	-	-	-	-	1° 9′ 57.3″	127° 35′ 10.2″
S4-25	4-B-1	<0.001	71	<1	-	-	-	-	1° 10′ 24.4″	127° 36′ 01.7″
S4-26	4-C-2	0.002	109	<1	-	-	-	-	1° 10′ 43.5″	127° 36′ 26.6″

○ **Zone 5**

A total of 26 stream sediment samples were collected in this zone inclusive of 9 for Wid stream, 4 for Awiri stream, 4 for Dunggurangher stream, 7 for Jia stream, and 2 for Saruata stream(Figure 7-1).

Based on the analysis result of stream sediment samples, Au 0.16ppm was detected at S5-3 spot in Awiri stream and less than Au 0.01ppm was for other samples(Figure 7-2 and Table 7-10).

In terms of the panned heavy mineral stream concentrate samples, there was no alluvial gold particle detected.

2 float rock samples were collected at R5-1 spot(Dunggurangher stream) and at R5-2 spot(upper Wid stream), but their analysis result produced less than Au 0.01ppm(Figure 7-3 and Table 7-10).

Table 7-10 Analysis Result of Stream Sediment Samples(Zone 5; unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb	Coordinates	
									N	E
S5-1	5-1	<0.01	NA	<1	NA	NA	NA	NA	1° 5′ 47.9″	127° 35′ 14.8″
S5-2	5-2	<0.01	NA	<1	NA	NA	NA	NA	1° 5′ 55.4″	127° 34′ 49.3″
S5-3	5-3	0.16	NA	<1	NA	NA	NA	NA	1° 6′ 03.2″	127° 36′ 39.9″
S5-4	5-4	<0.01	NA	<1	NA	NA	NA	NA	1° 6′ 26.7″	127° 36′ 45.8″
S5-5	5-5	<0.01	NA	<1	NA	NA	NA	NA	1° 5′ 22.3″	127° 36′ 04.5″
S5-6	5-6	<0.01	NA	<1	NA	NA	NA	NA	1° 5′ 34.1″	127° 35′ 38.7″
S5-7	5-7	<0.01	NA	<1	NA	NA	NA	NA	1° 5′ 09.8″	127° 35′ 14.6″
S5-8	5-8	<0.01	NA	<1	NA	NA	NA	NA	1° 5′ 33.1″	127° 36′ 39.5″
S5-9	5-9	<0.01	NA	<1	NA	NA	NA	NA	1° 5′ 37.4″	127° 36′ 58.3″
S5-10	5-10	<0.01	NA	<1	NA	NA	NA	NA	1° 5′ 47.9″	127° 37′ 05.0″
S5-11	5-11	<0.01	NA	<1	NA	NA	NA	NA	1° 5′ 47.8″	127° 36′ 36.3″
S5-12	5-12	<0.01	NA	<1	NA	NA	NA	NA	1° 6′ 18.2″	127° 37′ 12.8″
S5-13	5-13	<0.01	NA	<1	NA	NA	NA	NA	1° 6′ 01.5″	127° 37′ 26.5″
S5-14	5-14	<0.01	NA	<1	NA	NA	NA	NA	1° 6′ 20.2″	127° 37′ 45.9″
S5-15	5-15-1	0.002	64	<1	-	-	-	-	1° 6′ 19.6″	127° 34′ 41.9″
S5-16	5-16-1	0.002	64	<1	-	-	-	-	1° 5′ 41.1″	127° 33′ 41.3″
S5-17	5-17-1	0.003	24	<1	-	-	-	-	1° 5′ 26.8″	127° 34′ 09.7″
S5-18	5-18-1	<0.001	143	<1	-	-	-	-	1° 4′ 39.0″	127° 36′ 30.9″
S5-19	5-19-1	0.004	147	<1	-	-	-	-	1° 4′ 57.2″	127° 36′ 29.2″
S5-20	5-20-2	0.008	65	<1	-	-	-	-	1° 5′ 50.9″	127° 35′ 57.8″
S5-21	5-21-1	<0.001	41	<1	-	-	-	-	1° 5′ 45.4″	127° 36′ 06.2″
S5-22	5-22-2	<0.001	49	<1	-	-	-	-	1° 5′ 54.5″	127° 36′ 17.4″
S5-23	5-23-1	<0.001	45	<1	-	-	-	-	1° 6′ 06.2″	127° 36′ 22.8″
S5-24	5-24-1	<0.001	43	<1	-	-	-	-	1° 5′ 52.8″	127° 36′ 44.5″
S5-25	5-25-2	<0.001	39	<1	-	-	-	-	1° 6′ 14.1″	127° 36′ 42.0″
S5-26	5-26-2	<0.001	40	<1	-	-	-	-	1° 4′ 19.5″	127° 36′ 35.4″

Table 7-11 Analysis Result of Float Rock Samples(Zone 5; unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb
R5-1	K-5-1	<0.01	62	<1	200	0.21	60	3
R5-2	K-5-2	<0.01	46	<1	147	0.05	31	4

7.1.3 Result Analysis

○ Stream Sediment Survey

In this survey region, andesitic, basaltic, dacitic, pyroclastic rocks and tuff are distributed and therefore the maximum threshold should be acquired and set as the anomaly standard(maximum threshold=average +standard deviation), due to the mixed rock sediments rather than single ones.

According to the analysis of stream sediment samples in the survey region, the Au average and maximum threshold were 0.009ppm and 0.064ppm, respectively(Table 7-12).

This average is 2 times higher than that of general igneous rocks and hints at a strong possibility of mineralization.

Although the standard value should be higher than the maximum threshold, as previously explained, 0.05ppm was set as the anomaly standard, considering that of NHM's mine having similar geological conditions and deposits.

As exhibited in Figure 7-2 & 7-4 and Table 7-13, Sabeta stream(Zone 2, S2-5 spot, Au 0.05ppm), Tarusi stream(Zone 3, S3-3 spot, Au 0.56ppm), Donghar stream(Zone 3, S3-8 spot, Au 0.09ppm), and Awiri stream(Zone 5, S5-3 spot, Au 0.16ppm) satisfied the anomaly standard(Au≧0.05ppm).

○ Heavy Mineral Stream Concentrate Survey

As shown in Figure 7-2 and Table 7-13, minimum 3 alluvial gold particles, that is the anomaly standard for heavy mineral stream concentrate samples, were checked at 5 spots. Those spots are S2-11(4 particles) & S2-12(5 particles) of Sosam stream, S3-3(5 particles, Tarusi stream), S2-11(4 particles, Donghar stream), and S3-5(3 particles, Tajae stream).

○ **Float Rock Survey**

Although 10 float rock samples were collected in the survey region, except for R3-1 spot(Au 0.52ppm, Tarusi stream), there were no spots with the meaningful Au content.

Table 7-12 Statistical Analysis of Stream Sediment Samples in Survey Region

(unit : ppm)

	Average	Standard Deviation	Minimum	Maximum	Maximum Threshold
Au	0.009	0.055	0	0.56	0.064

Table 7-13 Situation of Au Anomaly Points in Regional Geochemical Survey

Location	Stream Sediment Samples			Heavy Mineral Stream Concentrate Samples		
	Location No.	Name of Stream	Result (ppm)	Location No.	Name of Stream	Result (particles)
Zone 2	S2-5	Sabeta	0.05	S2-11	Sosam	4
				S2-12		5
Zone 3	S3-3	Tarusi	0.56	S3-3	Tarusi	5
	S3-8	Donghar	0.09	S3-11	Donghar	4
				S3-5	Tajae	3
Zone 5	S5-3	Awiri	0.16			

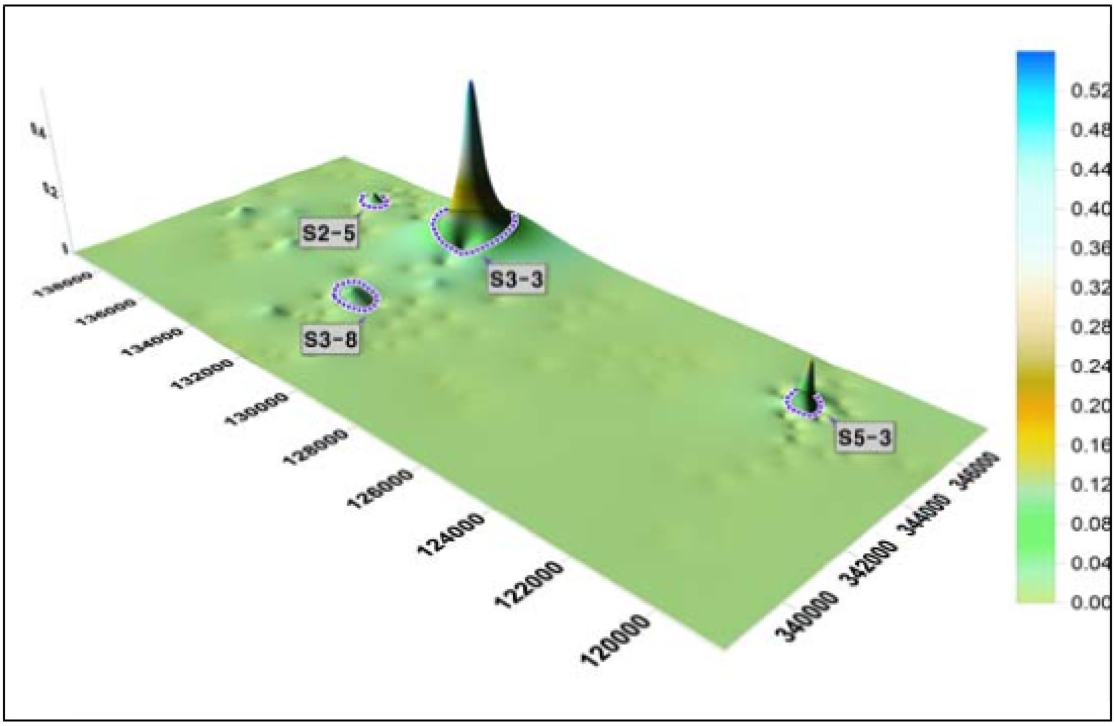


Figure 7-4 Anomalies of Stream Sediments (unit: ppm)

○ **Summary**

As a result, a gold ore body or mineralized zone is expected to develop in the upper watersheds at Sabeta and Sosam stream(Zone 2), Tarusi and Donghar stream(Zone 3), and Awiri stream(Zone 5). Hence, the following survey should be conducted in these stream areas(Table 7-13).

7.2 Basic Surface Geological Survey

7.2.1 Overview

As mentioned before, the basic surface geological survey was carried out in 5 zones by diving the survey region, just like the regional geochemical survey.

With respect to the regional geological features, the Gosowong Formation(Upper Miocene) is distributed in the eastern part of mine lots, the Tuff Formation(Pliocene) is in the western part, and the volcanic rocks

(Holocene) is in the northern part.

In Zone 1, 1 outcrop of quartz vein with Au content higher than the anomaly standard was found at upper Ngibut stream.

Development of a massive quartz vein along Sabeta stream is detected in Zone 2 and this is the Sabeta gold ore body, which was checked in the previous survey.

Concerning the Zone 3, 2 north-south faults are developed and the mineralization-related hydrothermal alteration zones are grown along these faults. In Donghar stream, felsite is subduced along tuff stratification near the hot spring.

In Zone 4, a mineralization-related quartz vein and felsite slightly exist.

In Zone 5, a small diorite body is subduced into the eastern ridges of Wid stream and more than 5 quartz and felsite vein are subduced along Dunggurangher stream and upper Wid stream. These veins are extended toward the boundaries in the southern mine lots and a trace of trenches and pitholes in the previous survey is left.

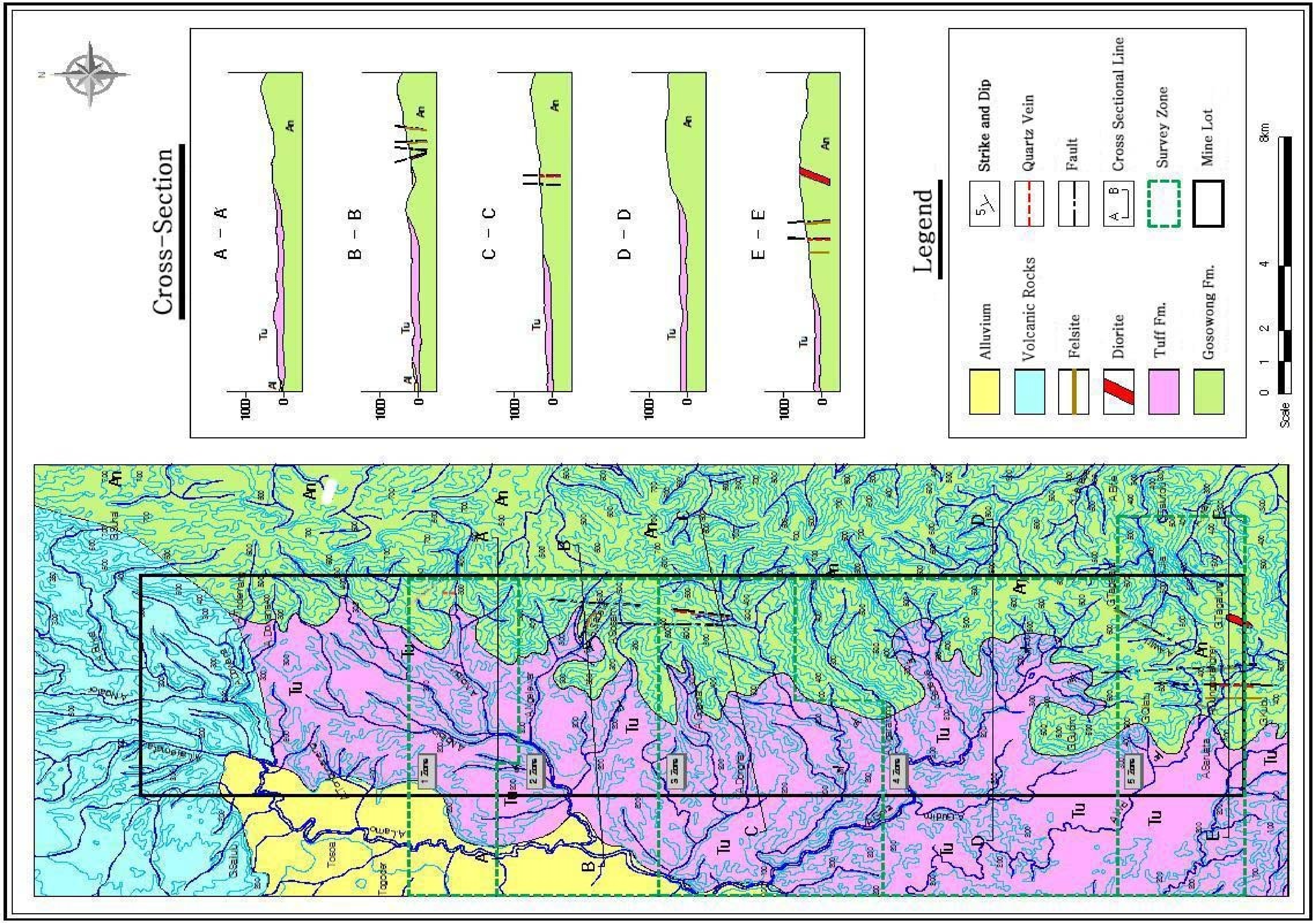


Figure 7-5 Geological Map of Survey Region

7.2.2 Result

○ **Zone 1**

In this zone, the Gosowong Formation(the eastern high land) and the Tuff Formation(the western valley and low land) are extensively distributed.

Andesite in the eastern Gosowong Formation takes on from gray to dark gray and altered porphyritic andesite is from green to sage green.

The western Tuff Formation wears from dark gray to black and brecciated tuff with pyroclastic breccia are developed in some parts. Stratification is also well developed and large rocks are formed in ridges and valleys. Particularly, there are many valleys along Ngibut stream(Photo 7-2).

An unconformity surface composed of dark gray tuff and streambed layers(Paleogene period) is displayed in the tributary running in the southeast of upper Ngibut stream(Photo 7-3).

In the northeast, a small fault with the strike of N5°W exists and a gold-bearing quartz vein(width: 0.3m) is developed along this fault. According to the analysis of 3 samples, LR-2 sample recorded Au 2.81ppm and this is the only sample higher value than the anomaly standard in this zone(Table 7-14).

It is highly likely that the mineralization occurred in the quartz vein intruded along the fault and thus understanding the development of quartz vein is required by the successive survey in the near future.

Also, in the Tuff Formation, there are a small fault(strike: N40°W) near the mid Ngibut stream and an alteration zone along the fault.

A microscopic observation on rock samples collected from upper Ngibut stream presents andesite and basalt. The phenocryst of andesite, mainly consisting of plagioclase and pyroxene along with a little muscovite, displays flow structures such as euhedral and subhedral(Photo 7-4).

In case of basalt, it is chiefly composed of plagioclase and pyroxene. A little olivine and muscovite are also found(Photo 7-5).

Table 7-14 Analysis Result of Ore Samples(Zone 1; unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb
LR-1	LR-1	0.02	17	<1	115	0.01	2	4
LR-2	LR-2	2.81	74	<1	150	0.02	<1	10
LR-3	LR-3	0.28	76	<1	712	0.05	8	3

Photo 7-2 Tuff Formation of Up and Midstream at Ngibut Stream

Photo 7-3 Unconformity Surface(Quaternary Period)

10×10, Cross Nicol	10×10, Open Nicol

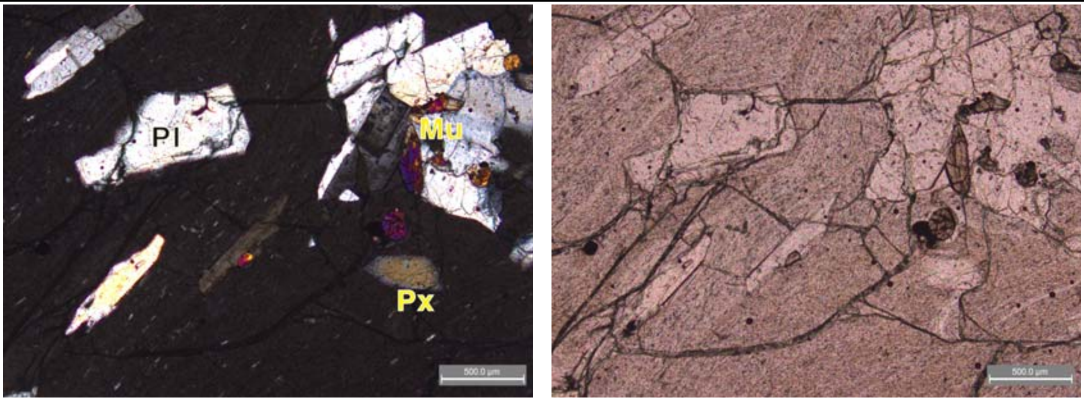


Photo 7-4 Microscopic Photo of Andesite

10×10, Cross Nicol	10×10, Open Nicol

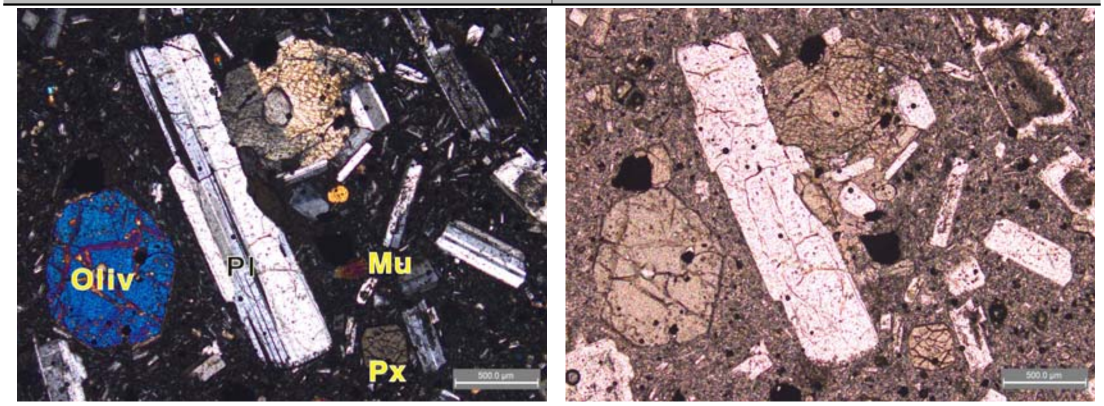


Photo 7-5 Microscopic Photo of Basalt 1

○ **Zone 2**

The Gosowong Formation, comprising andesite, andesitic porphyry, and quartz veins are developed in the eastern high land and the Tuff Formation are in the western low land.

Andesite of the Gosowong Formation is discovered near Sabeta stream and this is categorized into altered andesitic porphyry and unaltered andesite. Andesitic porphyry takes on from green to sage green and is altered by hydrothermal water when it is subducted into the quartz veins. Pyrite crystallization is disseminated within this andesitic porphyry (Photo 7-10) and andesite mostly assumes from gray to dark gray.

The Tuff Formation wears from gray to dark gray and stratification is well developed. Sometimes, cliff structures appear near Ngelewar stream. The strike of this formation is N20°～70°E and its dip is horizontal or gentle at around 5°.

Quartz veins are grown from the entry of Sabeta valley(strike: N70°W, dip: 70°～80°SW). The width is various, minimum 1～5m, maximum 70m and the length is over 1,200m. In addition, quartz veinlets(strike: almost N70°W, width: 1～5cm) are developed in the upper and lower wall of the quartz veins present a clustering stockwork pattern at the valley entry and at the waterfall region, about 850m distant from the valley entry. The width of these clustering stockwork gets bigger as a whole.

The quartz veins are produced by intruding along the similar fault in terms of strike and they are severely weathered in some parts. Thus, quartz-plagioclase particles are mixed with the reddish brown sedentary deposit of wall rock.

Besides, mineralization is observed including metal minerals such as pyrite, and comb and drusy structures are found almost all over the length of quartz veins. These are the same gold ore bodies which were discovered by K&I's internal geologists in the previous survey.

These quartz veins are cut almost vertically by other 3～5 NS-directed quartz veins(width: 0.5～1.0m).

In Sosam valley, south of Sabeta stream, there is a NS-directed fault with the width of 1.5m. This fault is viewed as the extension of the NS-directed fault developed in southern Tarusi area(Zone 3). The result of ore samples collected from this area is shown in Table 7-15.

Table 7-15 Analysis Result of Ore Samples in Sosam Stream (unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb
CR	CR-1	<0.01	135	<1	1250	0.08	<1	1

Examination of rock samples collected from Sabeta stream by polarization microscope shows that these samples consist of andesitic porphyry and basalt.

Specifically, andesitic porphyry chiefly contains lots of sericitic or agalmatolitic plagioclasic phenocryst through the alteration of hydrothermal water. This rock is dacitic and andesitic porphyry with a large amount of pyrite crystallization and clay(Photo 7-6), too.

Basalt is largely composed of plagioclase and pyroxene with euhedral and subhedral phenocyrstic structures and a small amount of Fe oxide(Photo 7-7).

In the XRD analysis, Si and O turn out to be main component elements and these elements form SiO_2, combination of Si and O(Photo 7-8).

10×10, Cross Nicol	10×10, Open Nicol

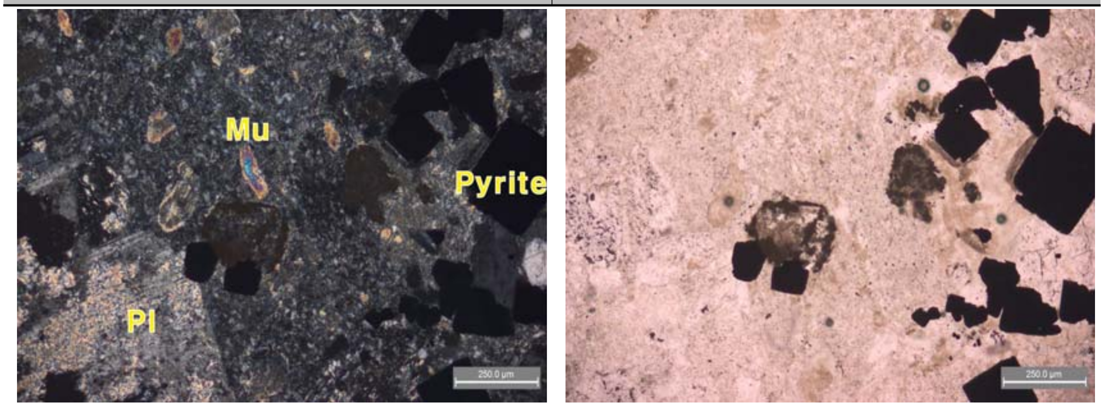


Photo 7-6 Microscopic Photo of Andesitic Porphyry

10×10, Cross Nicol	10×10, Open Nicol

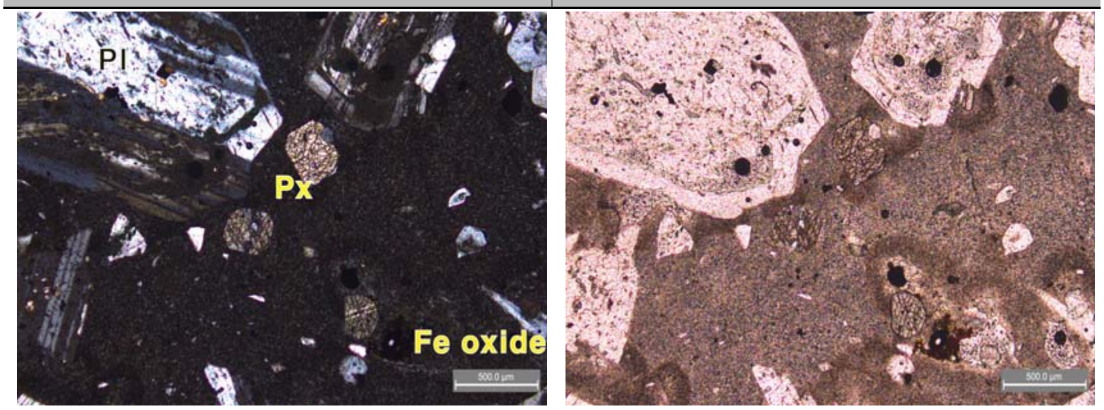


Photo 7-7 Microscopic Photo of Basalt 2

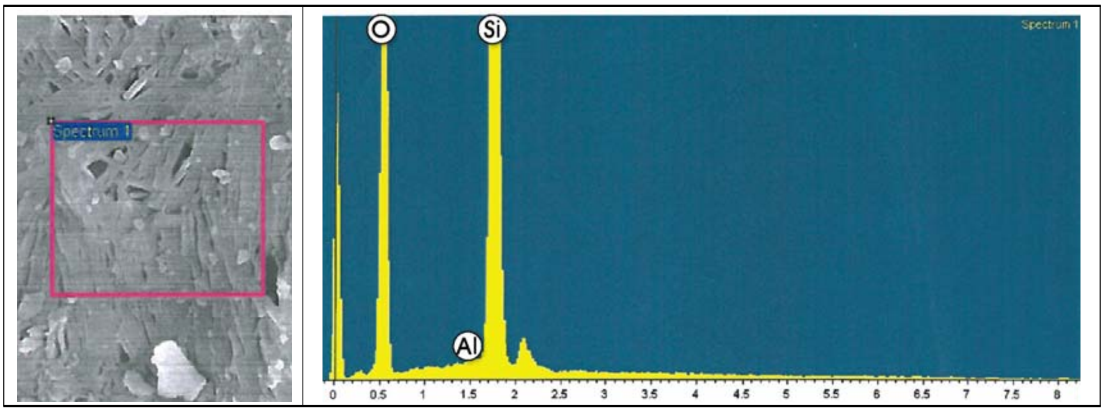


Photo 7-8 XRD Analysis of Quartz Vein

○ **Zone 3**

As the Zone 1 and 2, the Gosowong Formation is widely distributed in the eastern high land and the Tuff Formation is in the western valley and low land.

The Gosowong Formation is chiefly made up of andesite and wears from gray to dark gray.

The Tuff Formation is well developed in valleys and sometimes forms talus(Photo 7-10). Most of the Tuff Formation is dark gray and it is easily misunderstood as andesite(Photo 7-11). The strike of this formation is N20°～70°E and its dip is horizontal or gentle at around 5°.

There is a sulfur hot spring in the mid Donghar stream and its color is red due to oxide minerals. From white to light brown sill felsite in the vicinity of hot spring intrudes the Tuff Formation in the EW direction.

Felsite mainly consists of quartz and adularia and a kaoline alteration zone formed by weathering is found in the contact boundary with wall rock. Adularia is known for relating to an epithermal gold deposit.

An XRD analysis was conducted on sill felsite in order to find out its component elements. According to the analysis, its component elements are Si, Al, O, K, and S and these combine and produce SiO_2, K_2O, and Al_2O_3(Photo 7-9).

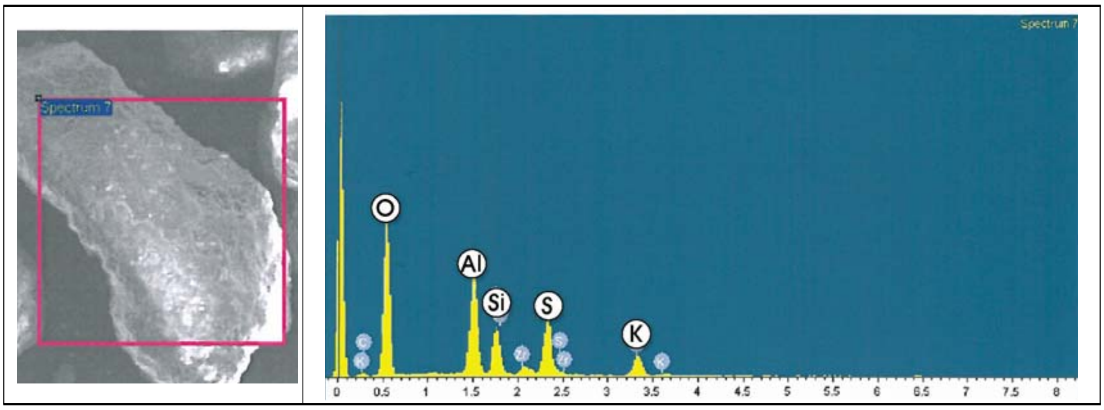


Photo 7-9 XRD Analysis of Felsite

In addition, the eruption of hot spring, which might be compositively related to the nearby mineralization along with felsite veins, indicates a tectonic line unexposed to the surface exists below the Tuff Formation.

In the eastern Tarusi area, small watersheds are formed in the east, west, and north ridges, placing Tarusi stream at the center. In the left side of Tarusi stream, a gray fault clay zone is located and it gets wider from 0.5m at the entry to 2.0m at the north ridge and extends up to a small tributary of the upstream. In the right side, there is a trace of past survey in trenches and pitholes at the entry.

In specific, the above NS-directed fault clay zone is considered to be connected to the NS-directed fault(main component: gray clay and breccia, width: 1.5m) in the northern Sosam valley.

The NNE-directed fault on the right side is thought to be linked to that of Sosam and Sabeta stream, with the almost same strike, over the northern ridges, given the several NNS fragmental zone of fault in the water system along with a trace of trenches and pitholes from the previous survey.

Photo 7-10 Tuff Talus at Tajae Stream

Photo 7-11 Tuff at Donghar Stream

○ **Zone 4**

Dark gray andesite of the Gosowong Formation is distributed in the eastern high land and gray～dark gray psephitic tuff of the Tuff Formation is in the western low land(Photo 7-12 and 7-13)

A lot of steep slopes exist in the relatively high east and southeastern region and many waterfalls are formed in the water system. For this reason, it was difficult to perform the relevant survey in Gudim mountain (west), upstream of Sadewa stream(central), and upstream of Gola stream(southeast).

Signs of mineralization such as the development of quartz or felsite vein and the alteration zone of wall rock were not detected in this zone.

Photo 7-12 Psephitic Tuff

Photo 7-13 Tuff Boulders at Ngararomu Stream

○ **Zone 5**

In this zone, the Gosowong Formation is mostly distributed in the east and the Tuff Formation is partly in the west.

The Gosowong Formation mostly comprises gray～dark gray andesite.

The Tuff Formation is composed of clay and silt-sized volcanic ashes and at the same time, black carbonaceous material are scattered along the stratification. This formation is almost horizontal and solidification is not proceeded yet.

Regarding the water system, there is a NS-directed watershed at Wid and Saruata stream in the west and at Jia stream in the east.

The Gosowong Formation starts from mid Wid stream, in the west of watershed.

3 felsite veins(Photo 7-14) and 1 narrow quartz vein, almost vertically crossing Dungguranghe r stream(tributary of Wid stream), intrude along the N5°W- and the N10°W-directed fault, respectively. Also, in upper Jia stream, there is a felsite vein intruding the N40°E-directed fault.

Photo 7-14 Felsite Vein at Dunggurangher Stream

A small scale dark green diorite intrudes into the southwestern ridge of Taigarung mountain in the southeastern part and a cluster of felsite veinlets is into this diorite body.

A trace of previous survey, including 1 trench(Photo 7-15) and 1 pithole(Photo 7-16), exists in the southern ridge at Dunggurangher stream of the mine lots along the aforementioned quartz vein, intruding into the N5°W-directed fault. Besides, 1 pithole(Photo 7-17) is also dug at the ridge in the southern boundary of the related mine lots.

A white quartz vein(width: 0.8m, Photo 7-18) and altered andesite with disseminated pyrite crystallization(Photo 7-19) were observed in the pithole. The microscopic examination on the rock samples collected from the pithole presents a quartz vein consisting of Qz, Ser, Fe oxide, and adularia(Photo 7-20).

4 samples(R5-6～5-9 spot) collected from the pithole in the southern ridge at Dunggurangher stream of mine lots contain slight Au; 0.03ppm at R5-7 and less than 0.01ppm for other spots.

Regarding the aforementioned 3 felsite veins and 1 quartz vein at Dunggurangher stream, 7 samples from these veins and the upper and lower alteration zones(R5-3～5-5 & R5-10～R5-13 spot) and 2 samples from the extension of southern boundary ridge(R5-14～R5-15) displayed insufficient mineralization with little Au content; 0.03ppm at R5-10, 0.02ppm at R5-14, 0.01ppm at R5-15, and less than 0.01ppm for other spots.

Photo 7-15 Trench in Southern Ridge at Dunggurangher Stream

Photo 7-16 NS-Directed Pithole in Southern Ridge at Dunggurangher Stream

Photo 7-17 Pithole in Southern Outer Ridge of Mine Lot

Photo 7-18 Altered Andesite and Quartz Vein Samples

Photo 7-19 Disseminated Pyrite within Altered Andesite

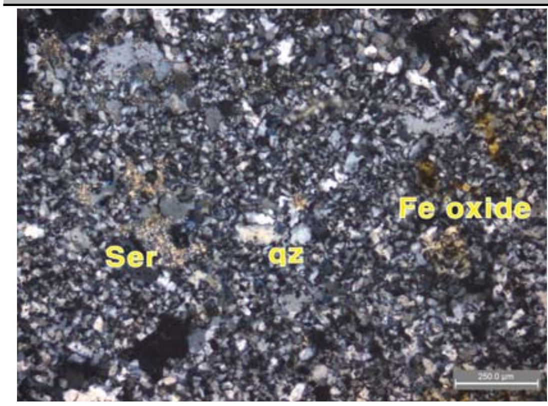
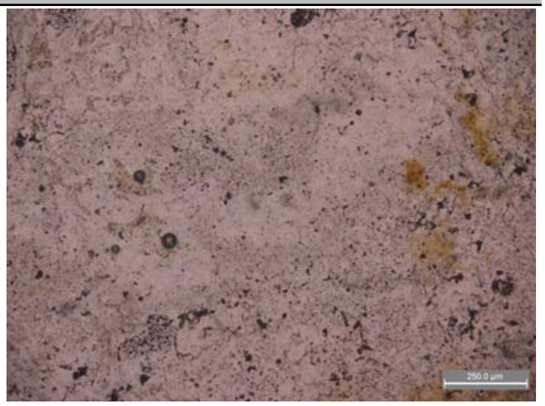
10×10, Cross Nicol	10×10, Open Nicol
	

Photo 7-20 Microscopic Photo of Quartz Vein

Table 7-16 Analysis Result of Ore Samples(Zone 5; unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb
R5-3	R-5-3	<0.01	15	<1	114	0.17	4	3
R5-4	R-5-4	0.02	47	<1	58	0.03	96	6
R5-5	R-5-5	<0.01	40	<1	69	0.29	68	5
R5-6	R-5-6	<0.01	16	<1	64	0.04	19	4
R5-7	R-5-7	0.03	82	<1	71	0.2	53	11
R5-8	R-5-8	<0.01	52	<1	43	0.07	35	9
R5-9	R-5-9	<0.01	89	<1	33	0.02	172	3
R5-10	R-5-10	0.03	12	<1	82	0.02	18	6
R5-11	R-5-11	<0.01	18	<1	365	0.01	3	4
R5-12	R-5-12	<0.01	3	<1	5	<0.01	8	5
R5-13	R-5-13	<0.01	12	<1	845	<0.01	6	4
R5-14	R-5-14	0.02	34	<1	72	<0.01	27	6
R5-15	R-5-15	0.01	74	<1	70	0.02	39	5

7.2.3 Result Analysis

- A gold-bearing quartz vein(width: 0.3m) intrudes along a small N5°W-directed fault at the northeastern part in Zone 1. According to the analysis result of 3 samples collected from the quartz vein, Au 2.81ppm was observed at LR-2 spot. This is the only sample recording higher grade than the anomaly zone in the basic surface geological survey.
- A quartz vein(strike: N70°W, dip: 70°～80°SW, width: 1～70m, length: over 1,200m) develops from the valley entry of Sabeta stream in Zone 2. This quartz vein is regarded as the same gold deposit, which was discovered by K&I's internal geologists in the previous survey.
- Although several signs of mineralization were observed, no positive mineralized zone nor gold ore body was detected in Zone 3, 4, and 5.

7.3 Selecting Detailed Geological Survey Areas

7.3.1 Criteria

○ Based on the regional geochemical survey and the basic surface geological survey, areas satisfying the following criteria are chosen for the candidates for the detailed geological survey.

- higher than Au 0.05ppm from the stream sediment samples (regional geochemical survey)
- more than 3 alluvial gold particles(anomaly standard) from the heavy mineral stream concentrate samples(regional geochemical survey)
- higher than Au 2ppm(anomaly standard) from the ore samples (basic surface geological survey)
- Rock outcrops such as quartz veins showing clear mineralization (basic surface geological survey)

○ 7 areas in the below table satisfy the above criteria(Table 7-17).

Table 7-17 Candidates of Detailed Geological Survey

Location	Regional Geochemical Survey						Basic Surface Geological Survey		
	Stream Sediment Samples			Heavy Mineral Stream Concentrate Samples					
	Sample No.	Name of Stream	Result (ppm)	Sample No.	Name of Stream	Result (particles)	Sample No.	Item	Result (ppm)
Zone 1							LR-2	Quartz Vein	2.81
Zone 2	S2-5	Sabeta	0.05					Quartz Vein	Width:1～70m Length: 1,200m
				S2-11	Sosam	4			
				S2-12		5			
Zone 3	S3-3	Tarusi	0.56	S3-3	Tarusi	5			
	S3-8	Donghar	0.09	S3-11	Donghar	4			
				S3-5	Tajae	3			
Zone 5	S5-3	Awiri	0.16						

7.3.2 Detailed Geological Survey Areas

ㅇ The following 3 areas were selected for the 1st detailed geological survey out of 7 areas, meeting at least 2 categories among the above 4 criteria (Table 7-18).

Table 7-18 Detailed Geological Survey Areas

Location	Regional Geochemical Survey						Basic Surface Geological Survey
	Stream Sediment Samples			Heavy Mineral Stream Concentrate Samples			
	Sample No.	Name of Stream	Result (ppm)	Sample No.	Name of Stream	Result (particles)	
Zone 2	S2-5	Sabeta	0.05				Quartz Vein (Width: 1～70m, Length: 1,200m)
Zone 3	S3-3	Tarusi	0.56	S3-3	Tarusi	5	
	S3-8	Donghar	0.09	S3-11	Donghar	4	

ㅇ Sabeta area including Sabeta Kecil stream in Zone 2 was selected for the detailed surface geological survey since the well developed gold deposit and quartz vein were found in the previous survey.

ㅇ Tarusi and Donghar area were chosen for the detailed geochemical survey since these areas respectively contained 1 sample with Au content and particle more than the anomaly standard each without any ore body presenting a definite mineralized zone or deposit.

ㅇ Later, it is necessary to perform an efficient additional survey for 4 areas excluded for the 1st detailed geological survey.

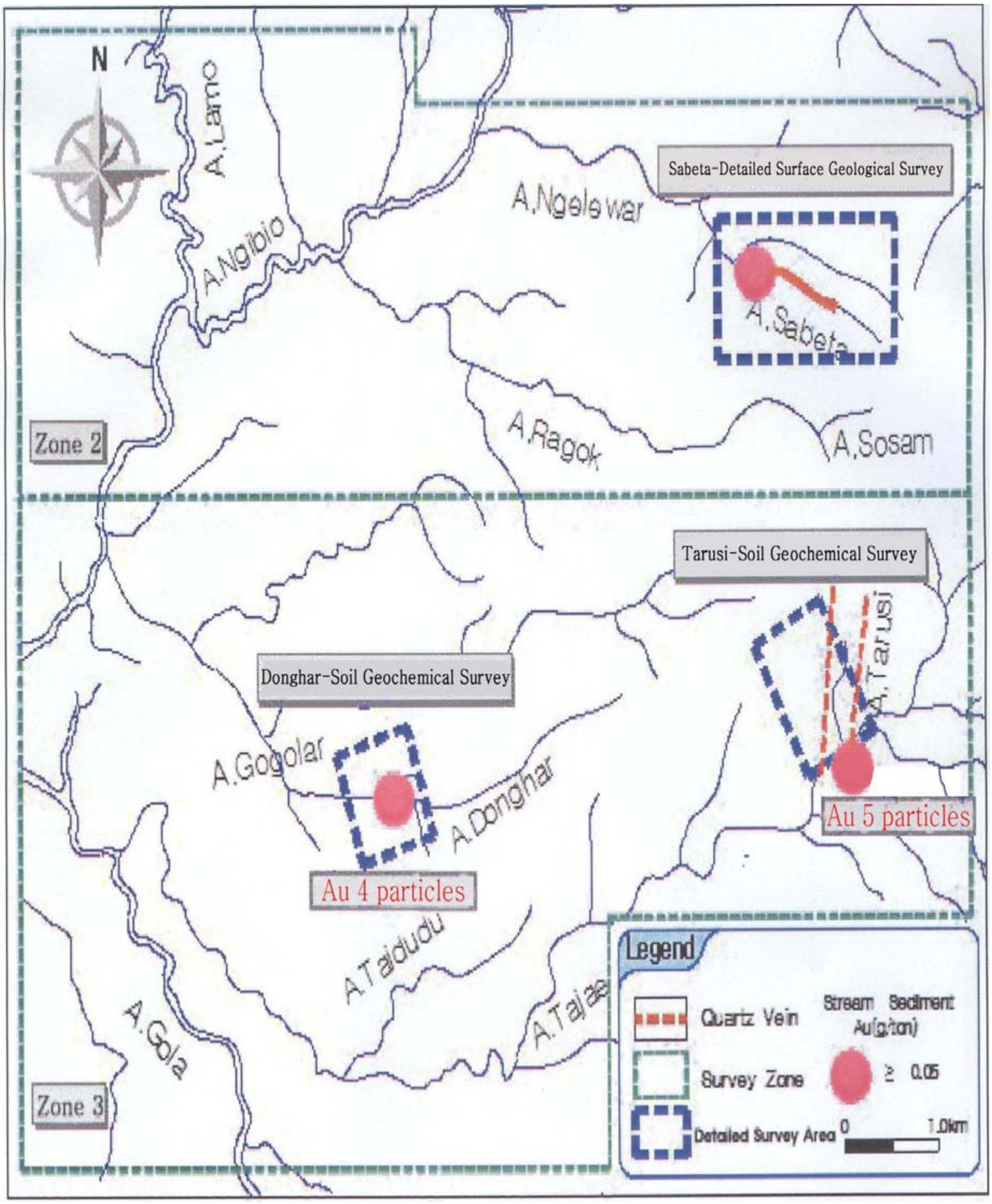


Figure 7-6 Location Map of Detailed Geological Survey Areas

8. DETAILED GEOLOGICAL SURVEY

8.1 Detailed Geochemical Survey

8.1.1 Overview

2 areas such as Tarusi stream and the mid tributary of Donghar stream in Zone 3 were selected for the detailed(or soil) geochemical survey.

In this survey, soil samples were collected from the soil layers, largely from the B layer and were analyzed for checking anomaly values.

Analysis values of soil samples were obtained and then anomaly points and zones of soil samples were reflected on the result map in order to figure out additional survey areas.

As a result, several anomaly points and zones were detected in Tarusi and Donghar area and suitable survey methods including trenching should be carried out in the near future.

8.1.2 Result

ㅇ Tarusi Area

The survey scope, displaying anomalies from the stream sediment and heavy mineral stream concentrate samples, was set up at Tarusi stream including ridges at both sides.

The direction of soil sampling location is shown in the below Table 8-1.

Table 8-1 Direction of Soil Sampling Location in Tarusi Area

Baseline Direction : N30°W	Sideline Direction : N60°E
Sampling Interval : 100m	Sampling Interval : 50m
Baseline No. : D3-1-1～D3-12-1	Sideline No. : D3-1-1～D3-1-14

A total number of samples was 172; 169 soil samples and 3 clay samples, regarded as fault clay(TS-1～TS-3).

The analysis result is displayed in the below Table 8-2 and 8-3.

Table 8-2 Analysis Result of Soil Samples in Tarusi Area

(unit: ppm)

Sample No.	Au	Ag	Coordinates	
			N	E
D3-1-1	<0.01	<1	1° 12′ 04.0″	127° 37′ 11.7″
D3-1-2	0.02	<1	1° 12′ 03.1″	127° 37′ 10.3″
D3-1-3	<0.01	<1	1° 12′ 02.2″	127° 37′ 09.0″
D3-1-4	<0.01	<1	1° 12′ 01.3″	127° 37′ 07.6″
D3-1-5	<0.01	<1	1° 12′ 00.4″	127° 37′ 06.2″
D3-1-6	<0.01	<1	1° 11′ 59.5″	127° 37′ 04.9″
D3-1-7	<0.01	<1	1° 11′ 58.7″	127° 37′ 03.5″
D3-1-8	<0.01	<1	1° 11′ 57.8″	127° 37′ 02.2″
D3-1-9	<0.01	<1	1° 11′ 56.9″	127° 37′ 00.8″
D3-1-10	0.01	<1	1° 11′ 56.0″	127° 36′ 59.4″
D3-1-11	<0.01	<1	1° 11′ 55.1″	127° 36′ 58.1″
D3-1-12	<0.01	<1	1° 11′ 54.3″	127° 36′ 56.7″
D3-1-13	<0.01	<1	1° 11′ 53.4″	127° 36′ 55.4″
D3-1-14	<0.01	<1	1° 11′ 52.5″	127° 36′ 54.0″
D3-1-15	<0.01	<1	1° 11′ 51.6″	127° 36′ 52.7″
D3-2-1	<0.01	<1	1° 12′ 06.7″	127° 37′ 09.9″
D3-2-2	<0.01	<1	1° 12′ 05.8″	127° 37′ 08.6″
D3-2-3	<0.01	<1	1° 12′ 04.9″	127° 37′ 07.2″
D3-2-4	<0.01	<1	1° 12′ 04.1″	127° 37′ 05.8″
D3-2-5	<0.01	<1	1° 12′ 03.2″	127° 37′ 04.5″
D3-2-6	<0.01	<1	1° 12′ 02.3″	127° 37′ 03.1″
D3-2-7	<0.01	<1	1° 12′ 01.4″	127° 37′ 01.7″
D3-2-8	<0.01	<1	1° 12′ 00.5″	127° 37′ 00.4″
D3-2-9	<0.01	<1	1° 11′ 59.6″	127° 36′ 59.0″
D3-2-10	<0.01	<1	1° 11′ 58.8″	127° 36′ 57.7″
D3-2-11	<0.01	<1	1° 11′ 57.9″	127° 36′ 56.3″
D3-2-12	<0.01	<1	1° 11′ 57.0″	127° 36′ 55.0″
D3-2-13	<0.01	<1	1° 11′ 56.1″	127° 36′ 53.6″
D3-2-14	0.02	<1	1° 11′ 55.2″	127° 36′ 52.2″
D3-3-1	<0.01	<1	1° 12′ 09.4″	127° 37′ 08.1″

(unit: ppm)

Sample No.	Au	Ag	Coordinates	
			N	E
D3-3-2	<0.01	<1	1° 12′ 08.6″	127° 37′ 06.8″
D3-3-3	<0.01	<1	1° 12′ 07.7″	127° 37′ 05.4″
D3-3-4	<0.01	<1	1° 12′ 06.8″	127° 37′ 04.1″
D3-3-5	<0.01	<1	1° 12′ 05.9″	127° 37′ 02.7″
D3-3-6	<0.01	<1	1° 12′ 05.0″	127° 37′ 01.4″
D3-3-7	<0.01	<1	1° 12′ 04.1″	127° 37′ 00.0″
D3-3-8	<0.01	<1	1° 12′ 03.2″	127° 36′ 58.6″
D3-3-9	<0.01	<1	1° 12′ 2.4″	127° 36′ 57.3″
D3-3-10	0.01	<1	1° 12′ 01.5″	127° 36′ 55.9″
D3-3-11	<0.01	<1	1° 12′ 00.6″	127° 36′ 54.6″
D3-3-12	<0.01	<1	1° 11′ 59.7″	127° 36′ 53.2″
D3-3-13	<0.01	<1	1° 11′ 58.9″	127° 36′ 51.8″
D3-3-14	<0.01	<1	1° 11′ 58.0″	127° 36′ 50.5″
D3-3-15	<0.01	<1	1° 11′ 57.1″	127° 36′ 49.1″
D3-4-1	<0.01	<1	1° 12′ 12.2″	127° 37′ 06.4″
D3-4-2	<0.01	<1	1° 12′ 11.3″	127° 37′ 05.0″
D3-4-3	<0.01	<1	1° 12′ 10.4″	127° 37′ 03.7″
D3-4-4	<0.01	<1	1° 12′ 09.5″	127° 37′ 02.3″
D3-4-5	1.5	<1	1° 12′ 08.7″	127° 37′ 01.0″
D3-4-6	<0.01	<1	1° 12′ 07.7″	127° 36′ 59.6″
D3-4-7	<0.01	<1	1° 12′ 06.9″	127° 36′ 58.2″
D3-4-8	<0.01	<1	1° 12′ 06.0″	127° 36′ 56.9″
D3-4-9	<0.01	<1	1° 12′ 05.1″	127° 36′ 55.5″
D3-4-10	<0.01	<1	1° 12′ 04.2″	127° 36′ 54.2″
D3-4-11	<0.01	<1	1° 12′ 03.3″	127° 36′ 52.8″
D3-4-12	<0.01	<1	1° 12′ 02.5″	127° 36′ 51.5″
D3-4-13	<0.01	<1	1° 11′ 58.9″	127° 36′ 51.8″
D3-4-14	<0.01	<1	1° 11′ 58.0″	127° 36′ 50.5″
D3-5-1	<0.01	<1	1° 12′ 14.9″	127° 37′ 04.6″
D3-5-2	<0.01	<1	1° 12′ 14.0″	127° 37′ 03.3″

(unit: ppm)

Sample No.	Au	Ag	Coordinates	
			N	E
D3-5-3	0.05	<1	1° 12′ 13.2″	127° 37′ 01.9″
D3-5-4	<0.01	<1	1° 12′ 12.3″	127° 37′ 00.6″
D3-5-5	<0.01	<1	1° 12′ 11.4″	127° 36′ 59.2″
D3-5-6	<0.01	<1	1° 12′ 10.5″	127° 36′ 57.9″
D3-5-7	<0.01	<1	1° 12′ 09.6″	127° 36′ 56.5″
D3-5-8	<0.01	<1	1° 12′ 08.7″	127° 36′ 55.1″
D3-5-9	<0.01	<1	1° 12′ 07.8″	127° 36′ 53.8″
D3-5-10	<0.01	<1	1° 12′ 07.0″	127° 36′ 52.4″
D3-5-11	<0.01	<1	1° 12′ 06.1″	127° 36′ 51.1″
D3-5-12	<0.01	<1	1° 12′ 05.2″	127° 36′ 49.7″
D3-5-13	<0.01	<1	1° 12′ 04.3″	127° 36′ 48.3″
D3-5-14	<0.01	<1	1° 12′ 03.4″	127° 36′ 47.0″
D3-6-1	<0.01	<1	1° 12′ 17.6″	127° 37′ 02.9″
D3-6-2	<0.01	<1	1° 12′ 16.8″	127° 37′ 01.5″
D3-6-3	<0.01	<1	1° 12′ 15.9″	127° 37′ 00.2″
D3-6-4	<0.01	<1	1° 12′ 15.0″	127° 36′ 58.8″
D3-6-5	<0.01	<1	1° 12′ 14.1″	127° 36′ 57.5″
D3-6-7	<0.01	<1	1° 12′ 12.3″	127° 36′ 54.7″
D3-6-8	<0.01	<1	1° 12′ 11.5″	127° 36′ 53.4″
D3-6-9	0.02	<1	1° 12′ 10.6″	127° 36′ 52.0″
D3-6-11	<0.01	<1	1° 12′ 08.8″	127° 36′ 49.3″
D3-6-12	0.01	<1	1° 12′ 07.9″	127° 36′ 48.0″
D3-6-13	<0.01	<1	1° 12′ 07.1″	127° 36′ 46.6″
D3-6-14	<0.01	<1	1° 12′ 06.2″	127° 36′ 45.2″
D3-6-15	<0.01	<1	1° 12′ 14.9″	127° 36′ 43.1″
D3-7-1	<0.01	<1	1° 12′ 20.4″	127° 37′ 01.1″
D3-7-2	<0.01	<1	1° 12′ 19.5″	127° 36′ 59.8″
D3-7-3	<0.01	<1	1° 12′ 18.6″	127° 36′ 58.4″
D3-7-4	<0.01	<1	1° 12′ 17.7″	127° 36′ 57.0″
D3-7-5	<0.01	<1	1° 12′ 16.9″	127° 36′ 55.7″

(unit: ppm)

Sample No.	Au	Ag	Coordinates	
			N	E
D3-7-6	<0.01	<1	1° 12′ 16.0″	127° 36′ 54.3″
D3-7-7	<0.01	<1	1° 12′ 15.1″	127° 36′ 53.0″
D3-7-8	<0.01	1	1° 12′ 14.2″	127° 36′ 51.6″
D3-7-9	<0.01	<1	1° 12′ 13.3″	127° 36′ 50.3″
D3-7-10	<0.01	<1	1° 12′ 12.4″	127° 36′ 48.9″
D3-7-11	<0.01	<1	1° 12′ 11.5″	127° 36′ 47.5″
D3-7-12	<0.01	<1	1° 12′ 10.7″	127° 36′ 46.2″
D3-7-13	<0.01	1	1° 12′ 09.8″	127° 36′ 44.8″
D3-7-14	<0.01	<1	1° 12′ 08.9″	127° 36′ 43.5″
D3-8-1	<0.01	<1	1° 12′ 23.1″	127° 36′ 59.4″
D3-8-2	<0.01	<1	1° 12′ 22.2″	127° 36′ 58.0″
D3-8-3	<0.01	<1	1° 12′ 21.4″	127° 36′ 56.7″
D3-8-4	<0.01	<1	1° 12′ 20.5″	127° 36′ 55.3″
D3-8-5	<0.01	<1	1° 12′ 19.6″	127° 36′ 53.9″
D3-8-6	<0.01	<1	1° 12′ 18.7″	127° 36′ 52.6″
D3-8-7	<0.01	1	1° 12′ 17.8″	127° 36′ 51.2″
D3-8-8	<0.01	<1	1° 12′ 16.9″	127° 36′ 49.9″
D3-8-9	<0.01	1	1° 12′ 16.0″	127° 36′ 48.5″
D3-8-10	<0.01	<1	1° 12′ 15.2″	127° 36′ 47.1″
D3-8-11	<0.01	<1	1° 12′ 14.3″	127° 36′ 45.8″
D3-8-12	<0.01	1	1° 12′ 13.4″	127° 36′ 44.4″
D3-8-13	<0.01	<1	1° 12′ 12.5″	127° 36′ 43.1″
D3-8-14	<0.01	<1	1° 12′ 11.6″	127° 36′ 41.7″
D3-9-1	<0.01	1	1° 12′ 25.8″	127° 36′ 57.6″
D3-9-2	<0.01	1	1° 12′ 25.0″	127° 36′ 56.3″
D3-9-3	<0.01	1	1° 12′ 24.1″	127° 36′ 54.9″
D3-9-4	<0.01	<1	1° 12′ 12.9″	127° 36′ 22.7″
D3-9-5	<0.01	<1	1° 12′ 22.3″	127° 36′ 52.2″
D3-9-6	<0.01	1	1° 12′ 21.4″	127° 36′ 50.8″
D3-9-7	<0.01	<1	1° 12′ 20.5″	127° 36′ 49.5″

(unit: ppm)

Sample No.	Au	Ag	Coordinates	
			N	E
D3-9-8	<0.01	1	1° 12′ 19.7″	127° 36′ 48.1″
D3-9-9	<0.01	<1	1° 12′ 18.8″	127° 36′ 46.8″
D3-9-10	<0.01	1	1° 12′ 17.9″	127° 36′ 45.4″
D3-9-11	<0.01	<1	1° 12′ 17.0″	127° 36′ 44.0″
D3-9-12	<0.01	1	1° 12′ 16.1″	127° 36′ 42.7″
D3-9-13	<0.01	1	1° 12′ 15.3″	127° 36′ 41.3″
D3-9-14	<0.01	<1	1° 12′ 14.4″	127° 36′ 40.0″
D3-10-1	<0.01	1	1° 12′ 28.6″	127° 36′ 55.9″
D3-10-2	<0.01	<1	1° 12′ 27.7″	127° 36′ 54.5″
D3-10-3	<0.01	<1	1° 12′ 26.8″	127° 36′ 53.2″
D3-10-4	<0.01	1	1° 12′ 25.9″	127° 36′ 51.8″
D3-10-5	<0.01	1	1° 12′ 25.1″	127° 36′ 50.4″
D3-10-6	0.02	<1	1° 12′ 24.2″	127° 36′ 49.1″
D3-10-7	<0.01	<1	1° 12′ 23.3″	127° 36′ 47.7″
D3-10-8	<0.01	1	1° 12′ 22.4″	127° 36′ 46.4″
D3-10-9	<0.01	<1	1° 12′ 21.5″	127° 36′ 45.0″
D3-10-10	<0.01	<1	1° 12′ 20.6″	127° 36′ 43.6″
D3-10-11	<0.01	<1	1° 12′ 19.7″	127° 36′ 42.3″
D3-10-12	<0.01	<1	1° 12′ 18.9″	127° 36′ 40.9″
D3-10-13	<0.01	<1	1° 12′ 18.0″	127° 36′ 39.6″
D3-10-14	<0.01	<1	1° 12′ 17.1″	127° 36′ 38.2″
D3-11-1	<0.01	<1	1° 12′ 31.3″	127° 36′ 54.1″
D3-11-2	<0.01	<1	1° 12′ 30.4″	127° 36′ 52.8″
D3-11-3	<0.01	<1	1° 12′ 29.6″	127° 36′ 51.4″
D3-11-4	<0.01	<1	1° 12′ 28.7″	127° 36′ 50.1″
D3-11-5	<0.01	1	1° 12′ 27.8″	127° 36′ 48.7″
D3-11-6	<0.01	<1	1° 12′ 26.9″	127° 36′ 47.3″
D3-11-7	<0.01	<1	1° 12′ 26.0″	127° 36′ 46.0″
D3-11-8	<0.01	<1	1° 12′ 25.1″	127° 36′ 44.6″
D3-11-9	0.01	<1	1° 12′ 24.2″	127° 36′ 43.2″

(unit: ppm)

Sample No.	Au	Ag	Coordinates	
			N	E
D8-11-10	<0.01	<1	1° 12′ 23.4″	127° 36′ 41.9″
D8-11-11	<0.01	<1	1° 12′ 22.5″	127° 36′ 40.5″
D8-11-12	<0.01	<1	1° 12′ 21.6″	127° 36′ 39.2″
D8-11-13	<0.01	<1	1° 12′ 20.7″	127° 36′ 37.8″
D8-11-14	<0.01	<1	1° 12′ 19.8″	127° 36′ 36.4″
D8-12-1	<0.01	<1	1° 12′ 34.0″	127° 36′ 52.3″
D8-12-2	<0.01	<1	1° 12′ 33.2″	127° 36′ 51.0″
D8-12-3	<0.01	<1	1° 12′ 32.3″	127° 36′ 49.6″
D8-12-4	0.02	<1	1° 12′ 31.4″	127° 36′ 48.3″
D8-12-5	0.03	<1	1° 12′ 30.5″	127° 36′ 46.9″
D8-12-6	<0.01	<1	1° 12′ 29.6″	127° 36′ 45.6″
D8-12-7	<0.01	<1	1° 12′ 28.8″	127° 36′ 44.2″
D8-12-8	<0.01	<1	1° 12′ 27.9″	127° 36′ 42.8″
D8-12-9	0.02	<1	1° 12′ 27.0″	127° 36′ 41.5″
D8-12-10	<0.01	<1	1° 12′ 26.1″	127° 36′ 40.1″
D8-12-11	<0.01	<1	1° 12′ 25.2″	127° 36′ 38.8″
D8-12-12	<0.01	<1	1° 12′ 24.3″	127° 36′ 37.4″
D8-12-13	<0.01	<1	1° 12′ 23.5″	127° 36′ 36.0″
D8-12-14	<0.01	<1	1° 12′ 22.6″	127° 36′ 34.7″
TS-1	<0.01	<1	-	-
TS-2	0.03	<1	-	-
TS-3	<0.01	<1	-	-

Table 8-3 Analysis Result of Clay Samples in Tarusi Area

(unit: ppm)

Sample No.	Au	Ag	Coordinates	
			N	E
TS-1	<0.01	<1	-	-
TS-2	0.03	<1	-	-
TS-3	<0.01	<1	-	-

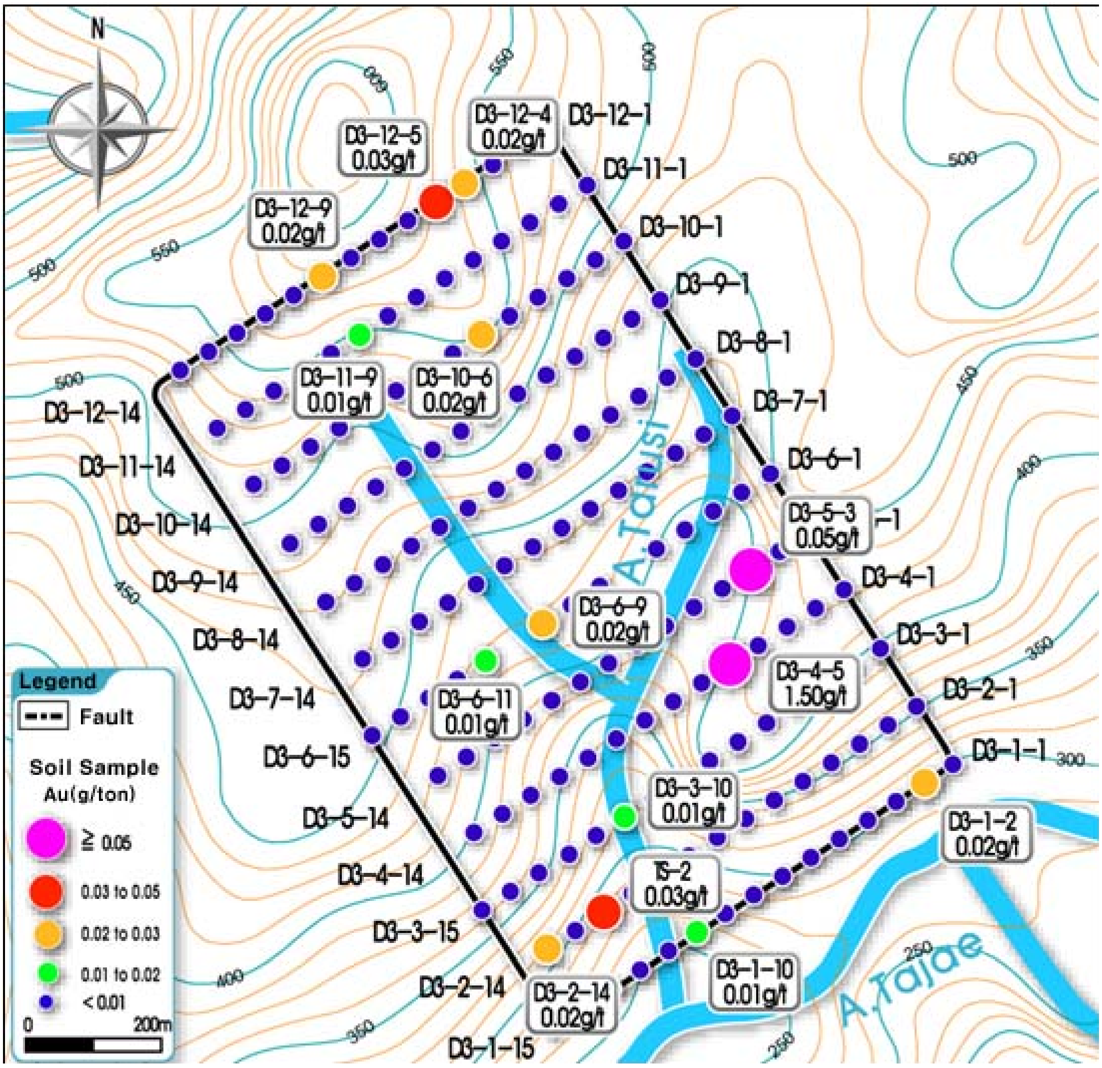


Figure 8-1 Result Map of Soil Geochemical Survey in Tarusi Area

An Au anomaly standard of this survey can be determined by utilizing a general threshold of igneous rock, that is the Au Clarke number 4ppb (0.004ppm)[1], since andesite of the Gosowong Formation is solely distributed in the relevant areas.

Under this situation, an anomaly standard can be the Au Clarke number, but a figure higher than Au 0.01ppm was set up as an anomaly standard in this survey, because the gold detection limit 10ppb(0.01ppm) in the lab of PT. Intertek Utama Services is larger than the Au Clarke number.

1) Laurence Robb, 2004, Introduction to Ore-Forming Processes, p24

According to the analysis result of soil samples, 14 samples contained higher than Au 0.01ppm(Figure 8-1).

Concretely, 5 spots in the right side of Tarusi stream held higher than the anomaly standard; D3-5-3(western slope, Au 0.05ppm), D3-4-5(western slope, Au 1.5ppm), D3-3-10(riverbed, Au 0.01ppm), D3-1-10(left entry, Au 0.01ppm), and D3-1-2 (eastern slope, Au 0.02ppm).

In the left side of Tarusi stream, 9 spots recorded higher than the anomaly standard; D3-12-4(eastern slope, Au 0.02ppm), D3-12-5(eastern slope, Au 0.03ppm), D3-12-9(western slope, Au 0.02ppm), D3-11-9(western valley, Au 0.01ppm), D3-10-6(left ridge, Au 0.02ppm), D3-6-9(southern subtributary of left ridge, Au 0.02ppm), D3-6-11(left slope of subtributary, Au 0.01ppm), TS-2(left slope of the entry, clay sample, Au 0.03ppm), and D3-2-14(Au 0.02ppm).

○ Donghar Area

The survey scope was determined to include the northern and southern ridge near the hot spring in Donghar stream where samples with Au content higher than the anomaly standard were observed from the stream sediment and heavy mineral stream concentrate survey.

The direction of soil sampling location is illustrated in the following Table 8-4.

Table 8-4 Direction of Soil Sampling Locations in Donghar Area

Baseline Direction : N15°W	Sideline Direction : N75°E
Sampling Interval : 100m	Sampling Interval : 50m
Baseline No. : D4-1-1～D4-9-1	Sideline No.: D4-1-1～D4-1-15

A total of 135 samples were collected in this area; 129 soil samples, 1 surface soil sample, and 5 ore samples from the contact zone of sill felsite vein and tuff. The analysis result of these samples are shown in Table 8-5 and 8-6.

An analysis unit of soil samples was ppb for Au and ppm for Ag and Cu. However, in this report, the unit was unified as ppm by converting ppb. Surface soil and ore samples were analyzed by a ppm unit. 7 analyzed elements are Au, Ag, Cu, Mn, Hg, As, and Sb.

Table 8-5 Analysis Result of Soil Samples in Donghar Area

(unit: ppm)

Sample No.	Au	Cu	Ag	Coordinates	
				N	E
D4-1-1	0.002	0.033	<0.001	1° 11′ 24.0″	127° 34′ 27.2″
D4-1-2	<0.001	0.029	<0.001	1° 11′ 24.4″	127° 34′ 28.7″
D4-1-3	0.002	0.037	<0.001	1° 11′ 24.8″	127° 34′ 30.3″
D4-1-4	0.004	0.035	<0.001	1° 11′ 25.1″	127° 34′ 31.9″
D4-1-5	0.003	0.04	<0.001	1° 11′ 25.5″	127° 34′ 33.5″
D4-1-6	0.016	0.039	<0.001	1° 11′ 25.9″	127° 34′ 35.0″
D4-1-8	0.002	0.029	<0.001	1° 11′ 26.7″	127° 34′ 38.2″
D4-1-9	0.003	0.082	<0.001	1° 11′ 27.1″	127° 34′ 39.7″
D4-1-11	0.002	0.03	<0.001	1° 11′ 27.9″	127° 34′ 42.9″
D4-1-12	0.003	0.039	<0.001	1° 11′ 28.2″	127° 34′ 44.4″
D4-1-14	<0.001	0.075	<0.001	1° 11′ 29.0″	127° 34′ 47.6″
D4-1-15	<0.001	0.039	<0.001	1° 11′ 29.4″	127° 34′ 49.2″
D4-2-1	<0.001	0.032	<0.001	1° 11′ 27.1″	127° 34′ 26.4″
D4-2-2	<0.001	0.031	<0.001	1° 11′ 27.5″	127° 34′ 28.0″
D4-2-3	<0.001	0.027	<0.001	1° 11′ 27.9″	127° 34′ 29.6″
D4-2-4	<0.001	0.028	<0.001	1° 11′ 28.3″	127° 34′ 31.1″
D4-2-5	0.001	0.064	<0.001	1° 11′ 28.7″	127° 34′ 32.7″
D4-2-6	<0.001	0.016	<0.001	1° 11′ 29.1″	127° 34′ 34.2″
D4-2-8	<0.001	0.036	<0.001	1° 11′ 29.8″	127° 34′ 37.4″
D4-2-10	<0.001	0.109	<0.001	1° 11′ 30.6″	127° 34′ 40.5″
D4-2-11	<0.001	0.14	<0.001	1° 11′ 31.0″	127° 34′ 42.1″
D4-2-12	<0.001	0.074	<0.001	1° 11′ 31.4″	127° 34′ 43.7″
D4-2-14	0.061	0.051	<0.001	1° 11′ 32.2″	127° 34′ 46.8″
D4-2-15	<0.001	0.129	<0.001	1° 11′ 32.6″	127° 34′ 48.4″
D4-3-1	<0.001	0.045	<0.001	1° 11′ 30.3″	127° 34′ 25.6″
D4-3-2	0.011	0.048	<0.001	1° 11′ 30.7″	127° 34′ 27.2″
D4-3-3	<0.001	0.032	<0.001	1° 11′ 31.5″	127° 34′ 30.3″
D4-3-4	0.002	0.029	<0.001	1° 11′ 31.1″	127° 34′ 28.8″
D4-3-5	<0.001	0.021	<0.001	1° 11′ 31.9″	127° 34′ 31.9″
D4-3-6	<0.001	0.058	<0.001	1° 11′ 32.2″	127° 34′ 33.5″

(unit: ppm)

Sample No.	Au	Cu	Ag	Coordinates	
				N	E
D4-3-7	<0.001	0.032	<0.001	1° 11′ 32.6″	127° 34′ 35.1″
D4-3-8	<0.001	0.061	<0.001	1° 11′ 33.0″	127° 34′ 36.6″
D4-3-9	<0.001	0.047	<0.001	1° 11′ 33.4″	127° 34′ 38.2″
D4-3-10	0.002	0.059	<0.001	1° 11′ 33.8″	127° 34′ 39.7″
D4-3-11	<0.001	0.03	<0.001	1° 11′ 34.2″	127° 34′ 41.3″
D4-3-12	<0.001	0.029	<0.001	1° 11′ 34.6″	127° 34′ 42.9″
D4-3-13	0.002	0.051	<0.001	1° 11′ 35.0″	127° 34′ 44.5″
D4-3-14	<0.001	0.08	<0.001	1° 11′ 35.3″	127° 34′ 46.0″
D4-3-15	<0.001	0.073	<0.001	1° 11′ 35.7″	127° 34′ 47.6″
D4-4-1	0.009	0.05	<0.001	1° 11′ 33.4″	127° 34′ 24.9″
D4-4-2	<0.001	0.076	<0.001	1° 11′ 33.8″	127° 34′ 26.4″
D4-4-3	0.014	0.04	<0.001	1° 11′ 34.2″	127° 34′ 28.0″
D4-4-4	<0.001	0.039	<0.001	1° 11′ 34.6″	127° 34′ 29.6″
D4-4-5	0.006	0.037	<0.001	1° 11′ 35.0″	127° 34′ 31.1″
D4-4-6	<0.001	0.049	<0.001	1° 11′ 35.4″	127° 34′ 32.7″
D4-4-7	<0.001	0.029	<0.001	1° 11′ 35.8″	127° 34′ 34.3″
D4-4-8	0.002	0.051	<0.001	1° 11′ 36.2″	127° 34′ 35.8″
D4-4-9	0.004	0.035	<0.001	1° 11′ 36.6″	127° 34′ 37.4″
D4-4-10	0.002	0.041	<0.001	1° 11′ 37.0″	127° 34′ 39.0″
D4-4-11	0.002	0.057	<0.001	1° 11′ 37.3″	127° 34′ 40.5″
D4-4-12	0.003	0.092	<0.001	1° 11′ 37.7″	127° 34′ 42.1″
D4-4-13	0.007	0.023	<0.001	1° 11′ 38.1″	127° 34′ 43.7″
D4-4-14	0.006	0.081	<0.001	1° 11′ 38.5″	127° 34′ 45.3″
D4-4-15	0.002	0.027	<0.001	1° 11′ 38.9″	127° 34′ 46.8″
D4-5-1	0.002	0.058	<0.001	1° 11′ 36.6″	127° 34′ 24.1″
D4-5-2	0.003	0.055	<0.001	1° 11′ 37.0″	127° 34′ 25.6″
D4-5-3	0.004	0.105	<0.001	1° 11′ 37.4″	127° 34′ 27.2″
D4-5-4	0.002	0.044	<0.001	1° 11′ 37.8″	127° 34′ 28.8″
D4-5-5	0.101	0.037	<0.001	1° 11′ 38.2″	127° 34′ 30.4″
D4-5-6	0.004	0.07	<0.001	1° 11′ 38.6″	127° 34′ 31.9″

(unit: ppm)

Sample No.	Au	Cu	Ag	Coordinates	
				N	E
D4-5-7	0.002	0.046	<0.001	1° 11′ 39.0″	127° 34′ 33.5″
D4-5-8	0.003	0.054	<0.001	1° 11′ 39.3″	127° 34′ 35.1″
D4-5-9	0.002	0.053	<0.001	1° 11′ 39.7″	127° 34′ 36.6″
D4-5-10	<0.001	0.033	<0.001	1° 11′ 40.1″	127° 34′ 38.2″
D4-5-11	0.002	0.036	<0.001	1° 11′ 40.5″	127° 34′ 39.8″
D4-5-12	0.002	0.051	<0.001	1° 11′ 40.9″	127° 34′ 41.4″
D4-5-13	<0.001	0.04	<0.001	1° 11′ 41.3″	127° 34′ 42.9″
D4-5-14	0.002	0.044	<0.001	1° 11′ 41.7″	127° 34′ 44.5″
D4-5-15	0.003	0.078	<0.001	1° 11′ 42.0″	127° 34′ 46.0″
D4-6-1	0.047	0.052	<0.001	1° 11′ 39.8″	127° 34′ 23.3″
D4-6-2	0.002	0.044	<0.001	1° 11′ 40.2″	127° 34′ 24.9″
D4-6-3	0.002	0.043	<0.001	1° 11′ 40.5″	127° 34′ 26.4″
D4-6-4	0.002	0.087	<0.001	1° 11′ 40.9″	127° 34′ 28.0″
D4-6-5	0.004	0.042	<0.001	1° 11′ 41.3″	127° 34′ 29.6″
D4-6-6	0.002	0.051	<0.001	1° 11′ 41.7″	127° 34′ 31.2″
D4-6-7	0.002	0.042	<0.001	1° 11′ 42.1″	127° 34′ 32.7″
D4-6-8	<0.001	0.034	<0.001	1° 11′ 42.5″	127° 34′ 34.3″
D4-6-9	0.002	0.063	<0.001	1° 11′ 42.9″	127° 34′ 35.9″
D4-6-10	0.002	0.077	<0.001	1° 11′ 43.3″	127° 34′ 37.4″
D4-6-11	0.003	0.072	<0.001	1° 11′ 43.7″	127° 34′ 39.0″
D4-6-12	0.002	0.036	<0.001	1° 11′ 44.1″	127° 34′ 40.6″
D4-6-13	0.002	0.04	<0.001	1° 11′ 44.5″	127° 34′ 42.1″
D4-6-14	0.007	0.066	<0.001	1° 11′ 44.8″	127° 34′ 43.7″
D4-6-15	0.01	0.066	<0.001	1° 11′ 45.2″	127° 34′ 45.3″
D4-7-1	0.002	0.082	<0.001	1° 11′ 42.9″	127° 34′ 22.5″
D4-7-2	<0.001	0.063	<0.001	1° 11′ 43.3″	127° 34′ 24.1″
D4-7-3	0.002	0.068	<0.001	1° 11′ 43.7″	127° 34′ 25.7″
D4-7-4	0.002	0.042	<0.001	1° 11′ 44.1″	127° 34′ 27.2″
D4-7-5	0.002	0.069	<0.001	1° 11′ 44.5″	127° 34′ 28.8″
D4-7-6	0.002	0.052	<0.001	1° 11′ 44.9″	127° 34′ 30.4″

(unit: ppm)

Sample No.	Au	Cu	Ag	Coordinates	
				N	E
D4-7-7	0.019	0.024	<0.001	1° 11′ 45.3″	127° 34′ 31.9″
D4-7-8	0.004	0.052	<0.001	1° 11′ 45.7″	127° 34′ 33.5″
D4-7-9	0.003	0.047	<0.001	1° 11′ 46.0″	127° 34′ 35.1″
D4-7-10	0.002	0.048	<0.001	1° 11′ 46.4″	127° 34′ 36.7″
D4-7-11	0.002	0.043	<0.001	1° 11′ 46.8″	127° 34′ 38.2″
D4-7-12	0.002	0.046	<0.001	1° 11′ 47.2″	127° 34′ 39.8″
D4-7-13	0.002	0.068	<0.001	1° 11′ 47.6″	127° 34′ 41.4″
D4-7-14	0.003	0.047	<0.001	1° 11′ 48.0″	127° 34′ 42.9″
D4-7-15	<0.001	0.034	<0.001	1° 11′ 48.4″	127° 34′ 44.5″
D4-8-1	0.003	0.084	<0.001	1° 11′ 46.1″	127° 34′ 21.7″
D4-8-2	0.002	0.097	<0.001	1° 11′ 46.5″	127° 34′ 23.3″
D4-8-3	0.002	0.044	<0.001	1° 11′ 47.2″	127° 34′ 26.5″
D4-8-4	0.002	0.069	<0.001	1° 11′ 46.9″	127° 34′ 24.9″
D4-8-5	0.002	0.058	<0.001	1° 11′ 47.6″	127° 34′ 28.0″
D4-8-6	0.002	0.026	<0.001	1° 11′ 48.0″	127° 34′ 29.6″
D4-8-7	0.002	0.033	<0.001	1° 11′ 48.4″	127° 34′ 31.2″
D4-8-8	0.004	0.054	<0.001	1° 11′ 48.8″	127° 34′ 32.7″
D4-8-9	0.007	0.042	<0.001	1° 11′ 49.2″	127° 34′ 34.3″
D4-8-10	0.002	0.043	<0.001	1° 11′ 49.6″	127° 34′ 35.9″
D4-8-11	<0.001	0.029	<0.001	1° 11′ 50.0″	127° 34′ 37.5″
D4-8-12	0.002	0.046	<0.001	1° 11′ 50.4″	127° 34′ 39.0″
D4-8-13	0.002	0.032	<0.001	1° 11′ 50.8″	127° 34′ 40.6″
D4-8-14	0.002	0.034	<0.001	1° 11′ 51.2″	127° 34′ 42.2″
D4-8-15	<0.001	0.015	<0.001	1° 11′ 51.6″	127° 34′ 43.7″
D4-9-1	0.007	0.058	<0.001	1° 11′ 49.3″	127° 34′ 21.0″
D4-9-2	0.003	0.064	<0.001	1° 11′ 49.6″	127° 34′ 22.6″
D4-9-3	0.002	0.062	<0.001	1° 11′ 50.0″	127° 34′ 24.1″
D4-9-4	0.003	0.047	<0.001	1° 11′ 50.4″	127° 34′ 25.7″
D4-9-5	0.005	0.052	<0.001	1° 11′ 50.8″	127° 34′ 27.2″
D4-9-6	0.003	0.084	<0.001	1° 11′ 51.2″	127° 34′ 28.8″

(unit : ppm)

Sample No.	Au	Cu	Ag	Coordinates	
				N	E
D4-9-7	0.004	0.111	<0.001	1° 11′ 51.6″	127° 34′ 30.4″
D4-9-8	0.002	0.022	<0.001	1° 11′ 52.0″	127° 34′ 32.0″
D4-9-9	0.005	0.149	<0.001	1° 11′ 52.4″	127° 34′ 33.5″
D4-9-10	0.005	0.124	<0.001	1° 11′ 52.8″	127° 34′ 35.1″
D4-9-11	0.002	0.035	<0.001	1° 11′ 53.1″	127° 34′ 36.7″
D4-9-12	<0.001	0.037	<0.001	1° 11′ 53.5″	127° 34′ 38.2″
D4-9-13	0.003	0.091	<0.001	1° 11′ 53.9″	127° 34′ 39.8″
D4-9-14	0.008	0.026	<0.001	1° 11′ 54.3″	127° 34′ 41.4″
D4-9-15	0.002	0.021	<0.001	1° 11′ 54.7″	127° 34′ 43.0″

Table 8-6 Analysis Result of Surface Soil Samples in Donghar Area

(unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb
DR-3-1	DR-3-1	0.02	8	<1	32	2.50	<1	4

Table 8-7 Analysis Result of Ore Samples in Donghar Area

(unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb
DRS-1	DRS-1	<0.01	NA	<1	NA	NA	NA	NA
DR-1	DR-1	<0.01	61	<1	74	0.06	7	5
DR-2	DR-2	<0.01	9	<1	164	0.03	<1	4
DR-3-2	DR-3-2	<0.01	22	<1	45	3.20	4	4
DR-3-3	DR-3-3	<0.01	116	<1	98	0.27	7	5

Given the fact that the Tuff Formation(Holocene) is distributed and a felsite vein is intruded in this area, the Au anomaly standard was set by statistically processing the analysis results of soil samples. The surface soil sample DR-3-1 is almost identical with the soil sample D4-4-10 in terms of location, but their characteristics are different. Therefore, DR-3-1 was excluded in the statistical processing.

As the result of statistical processing, an Au average was 0.004ppm, and a standard deviation and an anomaly standard(maximum threshold) were 0.011ppm, 0.015ppm, respectively(Table 8-8).

Table 8-8 Statistical Analysis of Soil Samples in Donghar Area

(unit: ppm)

Item	Average	Standard Deviation	Minimum	Maximum	Anomaly Standard
Au	0.004	0.011	0	0.101	0.015
Cu	0.052	0.024	0.015	0.149	0.076

According to the analysis result of soil samples, 5 samples contained Au higher than the anomaly standard(0.015ppm) as shown in Figure 8-2.

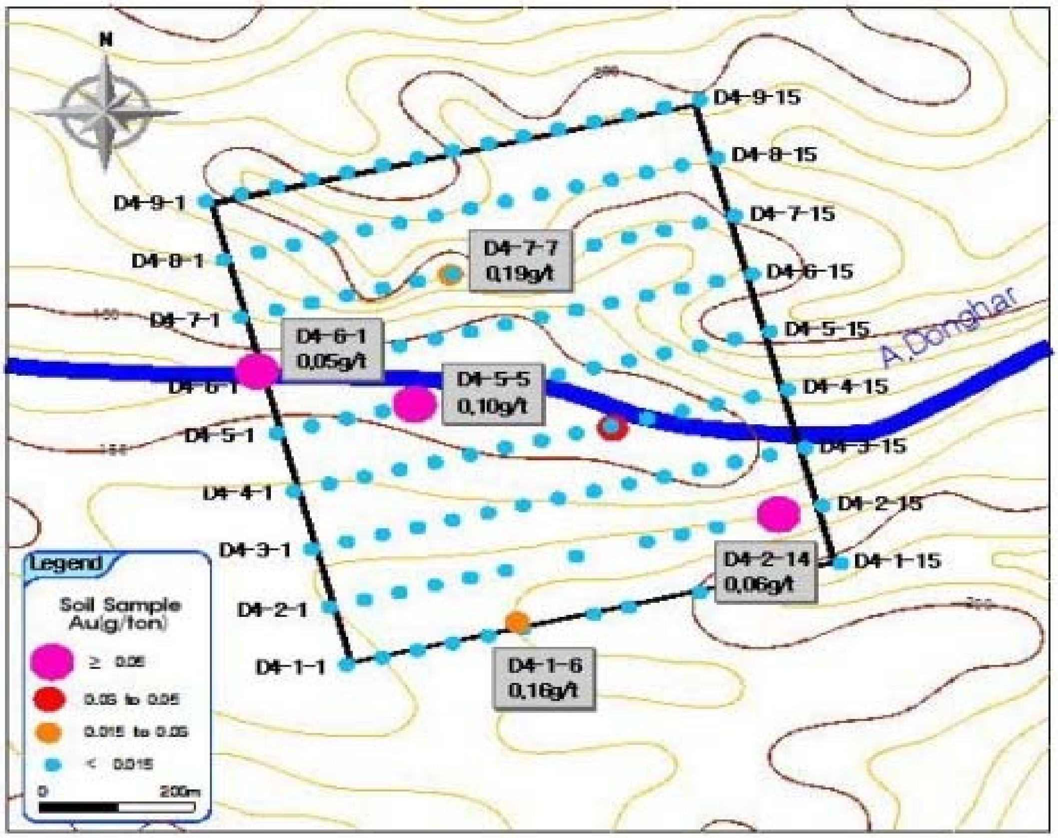


Figure 8-2 Result Map of Soil Geochemical Survey in Donghar Area

Anomaly points with Au content higher than the anomaly standard appear along Donghar stream, running across the relevant area in the EW direction.

There are 3 samples recorded higher than the anomaly standard in this area; D4-2-14(upstream slope, Au 0.06ppm), D4-5-5(mid & downstream, Au 0.10ppm), and D4-6-1(riverbed at downstream, Au 0.05ppm). Although the surface soil sample DR-3-1(up & midstream) contained Au 0.02ppm, it cannot be an anomaly point since it is considered to have the same characteristics with those of stream sediments.

Also, D4-1-6(southern ridge) and D4-7-7(northern slope) contained Au 0.016ppm and 0.019ppm, respectively.

8.1.3 Result Analysis

○ **Tarusi Area**

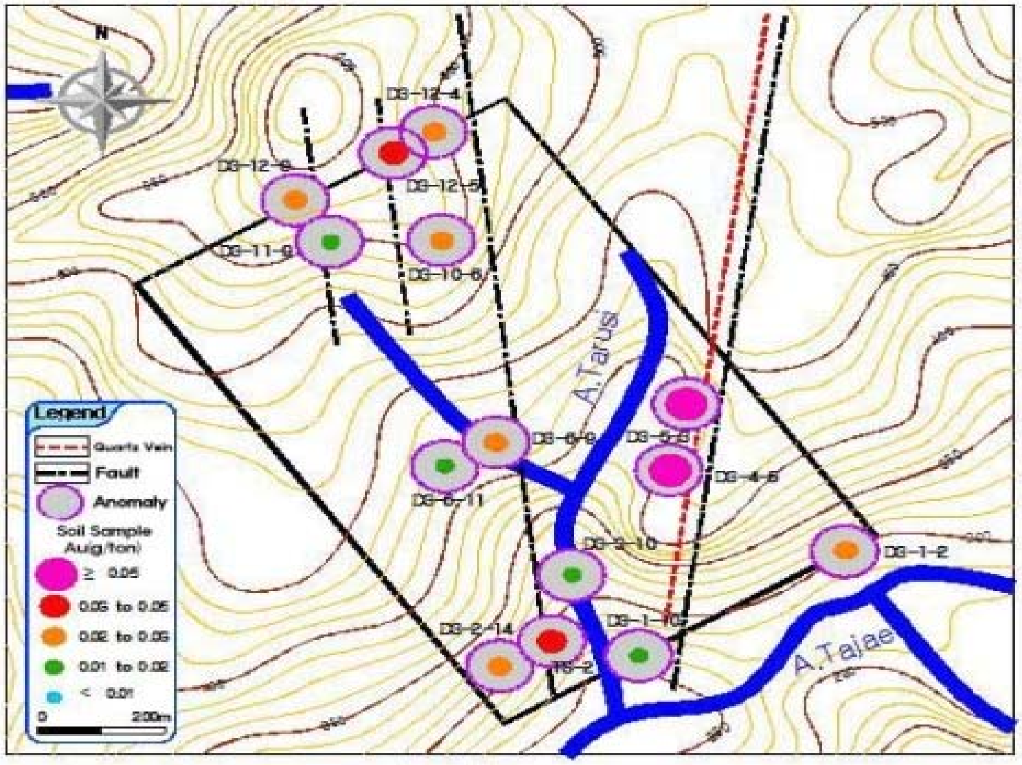


Figure 8-3 Anomalies of Soil Geochemical Survey in Tarusi Area

As illustrated in the above Figure 8-3, Au anomaly points recording Au content higher than the anomaly standard are almost same with those of basic surface geological survey.

In the right side of Tarusi stream, D3-4-5 with the highest Au 1.5ppm is at the center, D3-5-3 at NNE and D3-1-10 at SSW recorded Au 0.05ppm and 0.01ppm each. These 3 spots sit in a straight line at NNE direction and previous trenches and vertical pitholes exit between D3-4-5 and D3-1-10 spot.

Particularly, rock fragments of quartz vein are included in the sample at D3-4-5 and a strong NNE-directed fractured zone develops in the right outcrop at the confluence of Tajae stream. In addition, distinct Au anomaly zones appear at D3-4-5 and D3-5-3 as displayed in Figure 8-4. These support a good possibility of the development of mineralized zone in the ridge between the right slope and the above 3 spots along a NNE-directed fault. The NNE-directed fault is thought to be extended toward S2-11(4 alluvial gold particles were detected from heavy mineral stream concentrate samples in the regional geochemical survey), situated in the upstream region of northern Sosam stream(Figure 8-3).

However, considering the soil samples from the Au anomaly points, such as D3-3-10 and D3-1-2, collected mostly from the B layer, the source of Au anomaly points is presumed to exist at the higher level.

In the left side of Tarusi stream, a gray clay zone at TS-2(Au 0.03ppm), viewed as a fault clay, exists. And it develops off and on toward the northern ridge up to the northern small tributary at D3-6-9(Au 0.02ppm).

The width of this fault is about 0.5~2.0m and along this fault, mineralization seems to have occurred in some parts at TS-2 and D3-6-9. Also, this fault is believed to be extended toward S2-12 where 5 alluvial gold particles were found at the entry of NS-directed tributary at Sosam stream from the heavy mineral stream concentrates of regional geochemical survey(Figure 8-3).

In the left side of Tarusi stream, 5 spots such as D3-12-4(Au 0.02ppm), D3-12-5(Au 0.03ppm), D3-10-6(Au 0.02ppm), D3-6-11(Au 0.01ppm), and D3-2-14(Au 0.02ppm) showed Au anomalies higher than the anomaly standard. These spots are laid out almost parallel to the above fault.

However, they are located at higher level than the fault and thus it is very likely that they were not influenced by the mineralization occurred in the fault. The source of those Au anomaly points are not sure at present. Nonetheless, at higher level or near these spots, there is a possibility of mineralized zone.

Particularly, D3-12-5 and D3-12-4 with around 12m height difference are situated in the same sideline and form an Au anomaly zone. Therefor, it is very possible that a gold mineralized zone exists in the same level with or in a little higher than these two spots.

Besides, D3-12-9(western slope of left ridge) and D3-11-9(western valley) with about 30m height difference lie in the same baseline and go over the Au anomaly standard. Hence, it is also very likely that a gold mineralized zone exists in the same level with or in a little higher than these two spots(Figure 8-3, 8-4, and 8-5).

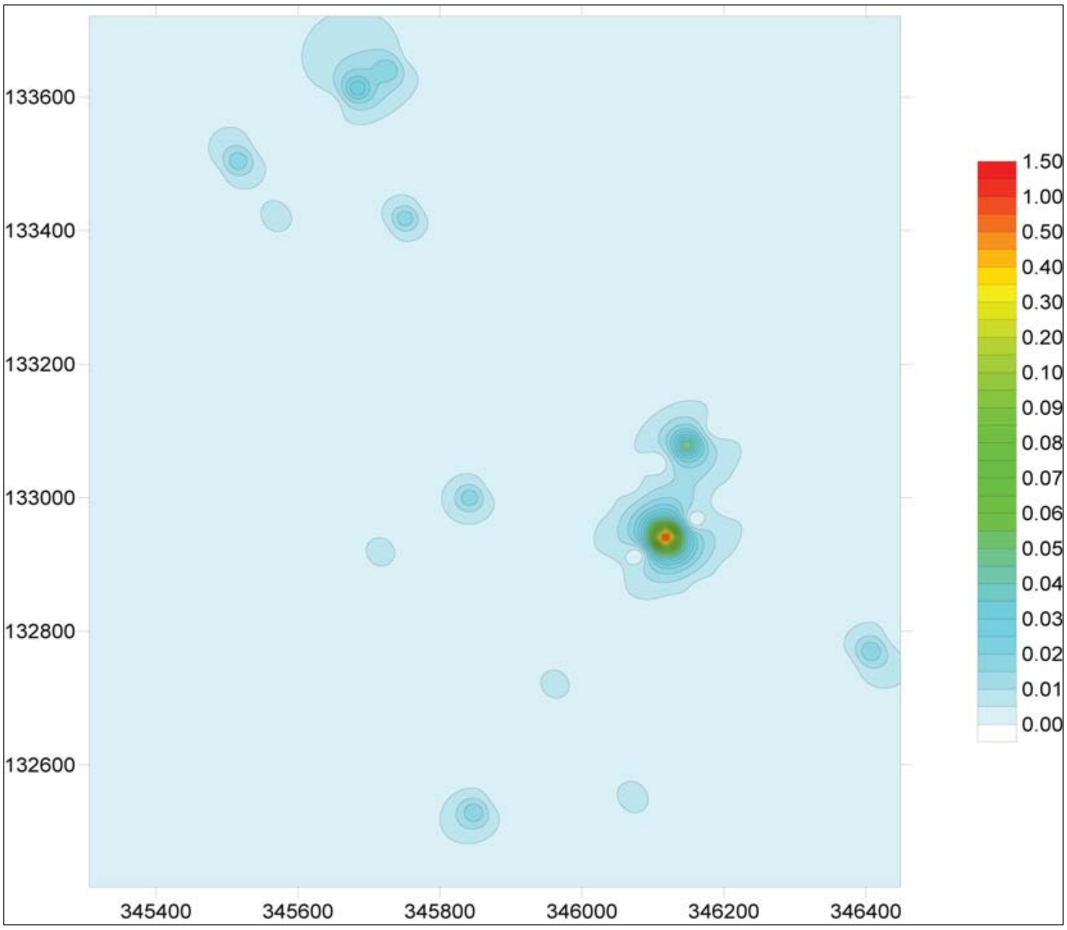


Figure 8-4 Au Distribution of Soil Geochemical Survey in Tarusi Area

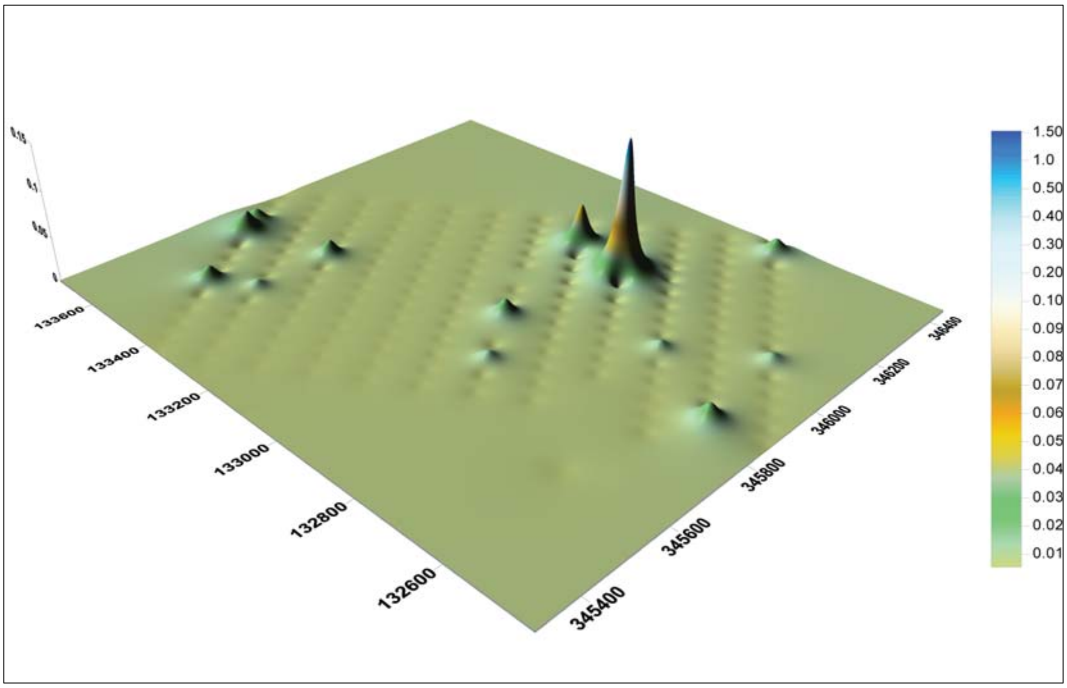


Figure 8-5 3D Map of Au Gold Distribution from Soil Geochemical Survey in Tarusi Area

Table 8-9 Situation of Au Anomaly Points and Zones in Tarusi Area

Location			Sample No.	Au Content (ppm)	Result	Others
Zone 3	Tarusi Area	Right Side of Tarusi Stream	D3-4-5	1.50	Au Anomaly Zone, in NNE Fault	East of Tarusi Stream
			D3-5-3	0.05		
			D3-1-10	0.01	Au Anomaly Point, in NNE Fault	
			D3-3-10	0.01	Anomaly Point	
			D3-1-2	0.02	Anomaly Point	
		Left Side of Tarusi Stream	TS-2	0.03	Anomaly Point, in NS Fault	West of Tarusi Stream
			D3-6-9	0.02	Anomaly Point, in NS Fault	
			D3-12-4	0.02	Anomaly Zone	
			D3-12-5	0.03		
			D3-10-6	0.02	Anomaly Point	
			D3-6-11	0.01	Anomaly Point	
			D3-2-14	0.02	Anomaly Point	
			D3-12-9	0.02	Anomaly Point, Same Baseline	
			D3-11-9	0.01	Anomaly Point, Same Baseline	

2 Au anomaly zones and 10 Au anomaly points were observed in Tarusi area, and thus an additional survey is required for checking their original mineralized zone and ore body in the near future(Table 8-9).

○ **Donghar Area**

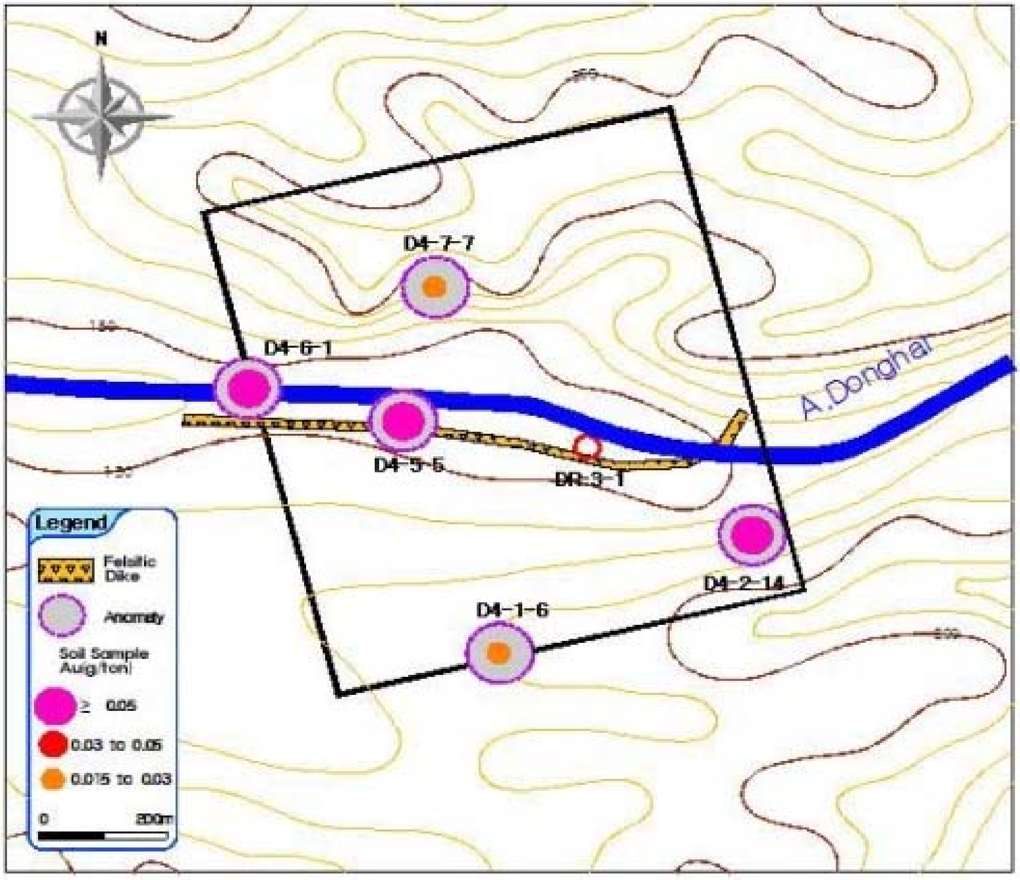


Figure 8-6 Anomalies of Soil Geochemical Survey in Donghar Area

There are two factors for the anomaly point at D4-2-14(Au 0.06ppm) in the upstream slope of Donghar stream. First, the original Au mineralized zone might exist in the southern slope or ridge. Second, this spot is a river terrace and the Au mineralized zone might exist in upper Donghar stream.

Concerning grounds for the factors, firstly, an anomaly point appears in the western ridge at D4-1-6 spot, located in the same ridgeline with the southern ridge. Secondly, there are anomaly points in the surface soil sample spots DR-3-1, D4-5-5, and D4-6-1 in the downstream, too(Figure 8-6).

In addition, the anomaly point of D4-5-5 and D4-6-1 might be resulted from the intruded sill felsite vein along the southern riverside. However, this is not the case because the analysis result of 5 ore samples collected at the contact zone of felsite and tuff vein displayed slight Au 0.01～0.02ppm.

Although there are a hot spring in the vicinity of DR-3-1(near D4-4-10) and a tectonic line, playing a role of a channel for hyperthermal water and filled by a gold-bearing quartz vein, it is not quite sure that D4-5-5 and D4-6-1 are the original Au anomaly points(Figure 8-6).

The anomaly point of D4-7-7(Au 0.019ppm) in the northern slope of Donghar stream hints the existence of mineralized zone in the northern ridge or between the northern ridge and D4-7-7.

The Au distribution of Donghar area, resulted from the soil geochemical survey, is displayed in Figure 8-7 and 8-8.

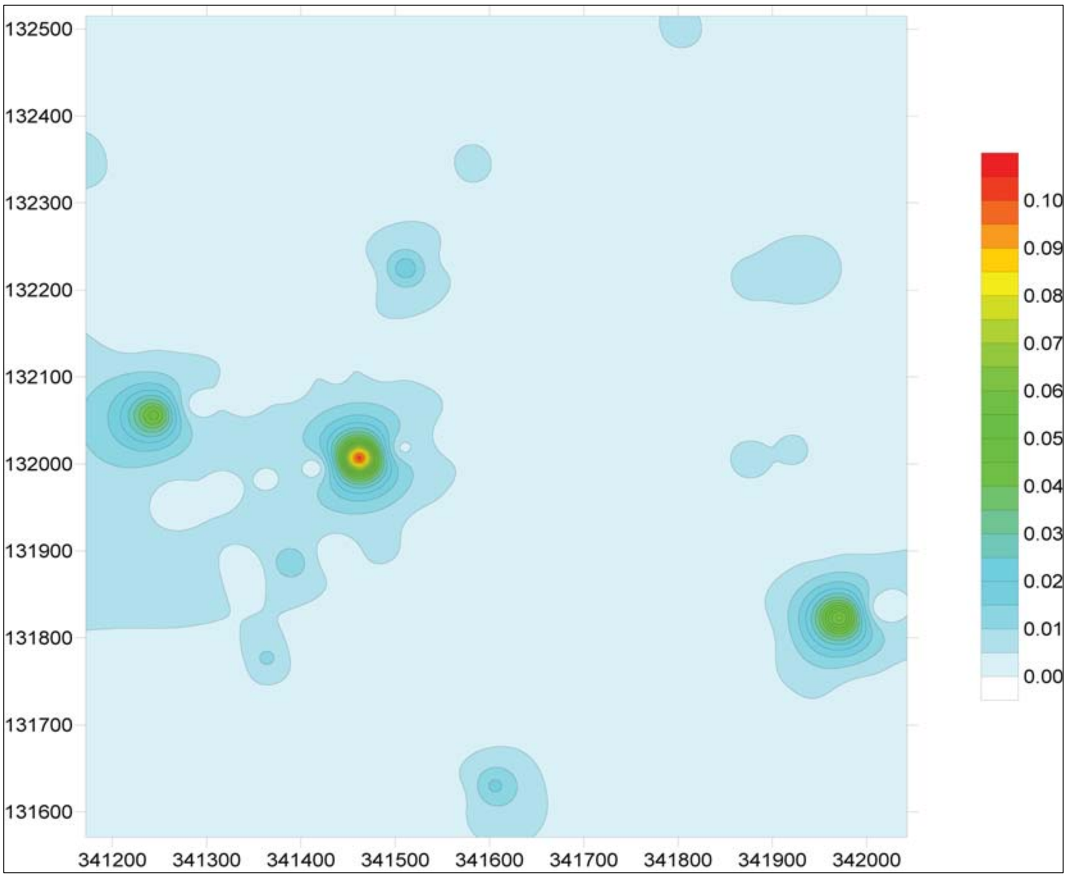


Figure 8-7 Au Distribution of Soil Geochemical Survey in Donghar Area

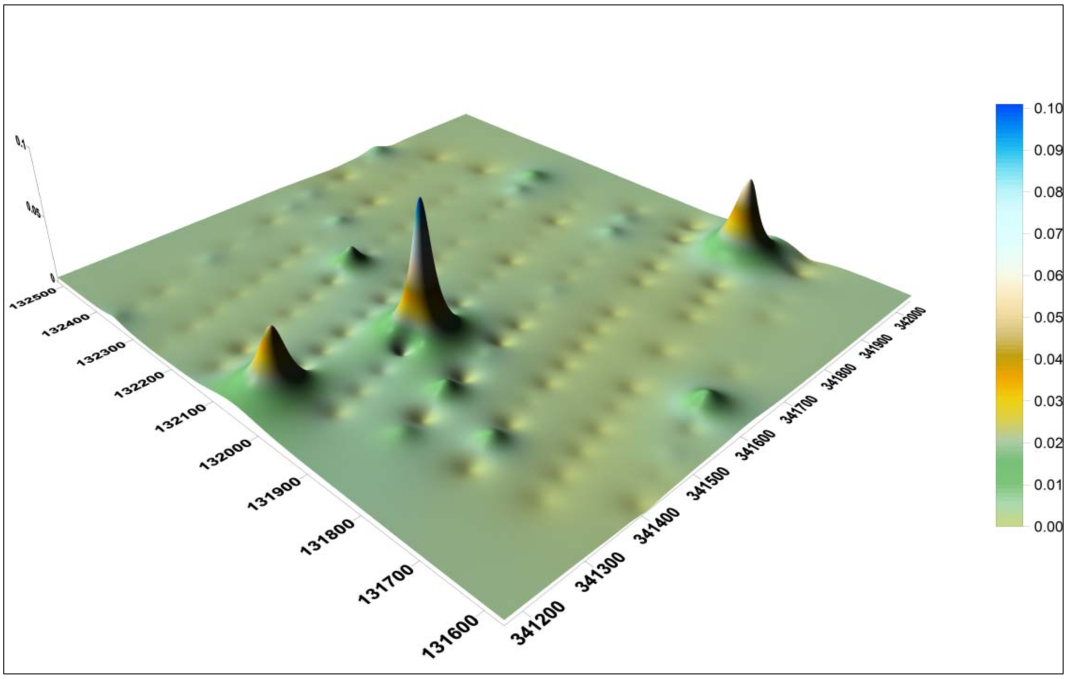


Figure 8-8 3D Map of Au Distribution of Soil Geochemical Survey in Donghar Area

Table 8-10 Situation of Au Anomaly Points and Zones in Donghar Area

Location		Sample No.	Au Content (ppm)	Result	Others
Zone 3	Donghar Area	D4-2-14	0.060	Anomaly Point	
		D4-5-5	0.100	Anomaly Point	
		D4-6-1	0.050	Anomaly Point	
		D4-4-6	0.016	Anomaly Point	
		D4-7-7	0.019	Anomaly Point	

5 gold anomaly points are distributed in Donghar area and therefore an additional survey is promptly required to find their original mineralized zones and deposits(Table 8-10).

8.2 Detailed Surface Geological Survey

8.2.1 Overview

Although K&I's geologists has found the massive gold-bearing quartz vein in Sabeta area in 2007, the successive survey has not proceeded swiftly.

However, the regional geological survey resumed in Sabeta area in 2012 and Au 0.05ppm was detected in stream sediment samples. Additionally, the above quartz vein turned out to be the massive one(width: 1～70m, length: over 1,200m).

Under this situation, the detailed geological survey has been performed in Sabeta area including Sabeta Kecil stream in order to understand the accurate scope and the development situation of the relevant quartz vein.

Considering the previous borehole(slope: 60°) of NHM's mine exists in the neighborhood, this area also has been paid attention to by Newcrest Mining Ltd., the Australian mother company of NHM(Photo 8-1).

Photo 8-1 Borehole in NHM Mine

8.2.2 Result

○ **Sabeta Stream Area**

Geology and deposit of Sabeta area are explained according to the way points of route map from the detailed surface geological survey in this section(Figure 8-9).

Dark gray tuff(the Tuff Formation) is observed from way point 1 and gray andesite(the Gosowong Formation), partly greenish, is distributed between way point 3 and 4.

A stockwork quartz veinlet is begun to be seen at way point 13 and a quartz vein(width: 50m, this is viewed as th main quartz vein, here) appears about 20m ahead of way point 14. Since the stockwork quartz veinlet, which is mineralized as a whole, is about 30m wide and the main quartz vein is presumed to be over 70m wide(Photo 8-2). Although the extension of main quartz vein is covered by surface soil, it is assumed to be extended toward the western slope of Sabeta stream. Also, the strike of main quartz vein is N80°W or so, but it is changed to N20°W with the narrower width of 15m at way point 16. Nonetheless, its overall width is assumed to be over 50m given the width of stockwork quartz veinlet.

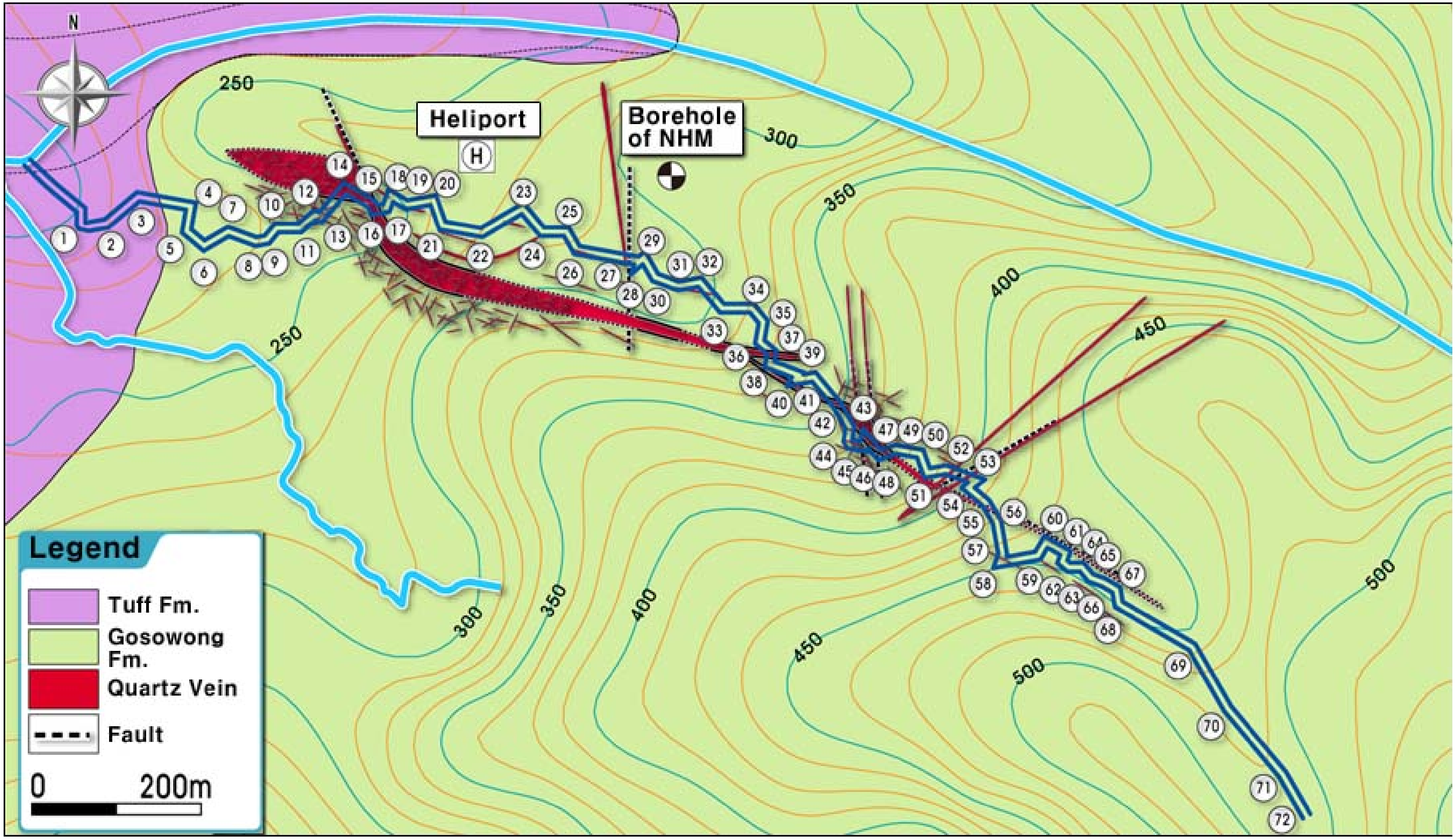


Figure 8-9 Route Map of Detailed Surface Geological Survey in Sabeta Area

The strike of main quartz vein is altered to N20°W, influenced by the fault with the strike of N20°W between way point 16 and 17 and this fault is intruded by a quartz vein(width: about 0.2m, length: about 70m), as shown in Photo 8-3.

There is a SE-directed trench at way point 18 and a small pithole for exploring quartz veinlets at way point 21(Photo 8-4).

In the southern slope of way point 21, that is the sampling spot 28 and 29, the main quartz vein(strike: N80°W, dip: 75°NE) develops, holding 2 pitholes in its hanging wall. Near these pitholes, the main quartz vein(width: 68m) is detected in a NE-directed trench(strike: N45°E, length: about 100m) dug by PT. Aneka Tambang Tbk(ANTM). In addition, there is a pithole(depth: 8m) dug in the footwall of the main quartz vein at the end of this trench and a stockwork quartz vein develops in an alteration zone.

A NS-directed fault and its subfault(strike: N10°W) are found at way point 27 and a quartz vein(width: about 1m, length: over 200m) intrudes along the subfault. A pithole is made to check the northen extension of this quartz vein(Photo 8-5). 3 trenches(strike: NS, EW, and N50°E, length: 10m, 80m, and 50m) are dug in the sampling spot 27 in the southern slope of way point 31. 4 quartz veinlets(strike: EW, width: 5～10cm) are developed at the interval of 5～40cm in the first waterfall at way point 32(Photo 8-7).

Photo 8-2 Development of Quartz Veinlet Group

Photo 8-3 Intrusion of Quartz Vein into Fault

Photo 8-4 Pithole at Way Point 21

The main quartz vein is re-covered by surface soil from way point 32 to the southern slope of way point 33.

The main quartz vein(strike: N70°W, dip: 70°NE, width: around 10m) is observed in the trench at the southern slope of way point 33 and this trench is found up to way point 37. The main quartz vein(width: around 10m) is extended to the northern slope of way point 39 across Sabeta stream and then it disappears into surface soil.

The strike and dip of main quartz vein is N70°W and 75°NE from way point 21 throughout way point 39 and its total length is estimated about 700m(the northern stream 180m+the southern stream 520m).

The width of main quartz vein(including the stockwork quartz veinlet) maintains about 70m up to the southern ridge of way point 22. From this point, the main vein is covered by surface soil up to the southern slope of way point 29, but it is considered to be well developed. Also, the stockwork quartz veinlet disappears up to the southern slope of way point 32 and only the main quartz vein develops with the width of around 15m.

Besides, 1～4 quartz veinlets intermittently develop between way point 15 and 33, and a quartz veinlet(width: about 1m) exists in the southern slope of way point 20～24.

A quartz vein(strike: N60°W) is cut by the main quartz vein in the southern slope of way point 36 and this vein is viewed as the secondary quartz vein, here. Also, the secondary quartz vein maintains the width of 3～7m between way point 36 and 40 and it continues to be extended toward the direction of S60°E.

The secondary quartz vein has a banded structure with the width of 7～10m between way point 40 and 42 where the second waterwall is located.

Around way point 46, the secondary quartz vein contains an irregularly intruded felsite vein, whose main component is adularia(Photo 8-8).

The secondary quartz vein changes its strike from N60°W to N20°W between way point 46 and 47 where the third waterfall is situated. This vein also alters from banded to stockwork structure and becomes wider over 15m. Given stockwork veinlets developed in the upper and lower wall of secondary quartz vein, the overall width is estimated about 50m. This, coupled with the waterfall topography and the silification of contact zone in the secondary quartz vein and wall rock, appears to be related to the nearby 2 faults(strike: N10°W). 2 quartz veins are intruded along these faults(width: around 1m, length: around 170m).

The secondary quartz vein is 1~5m wide with the strike of N60°W from way point 46~47 to way point 68~69 where it disappears.

2 faults(strike: N40°E and N50°E, width: about 1m, length: 390m and 450m) are developed near way point 52 and 53.

There are horizontal and vertical pitholes at both sides of Sabeta stream at way point 52(Photo 8-9 and 8-10). 1~2 N60°W-directed veinlets are developed on and off in the hanging wall of secondary quartz vein between way point 57 and 68.

The secondary quartz vein is extended about 600m(strike: N60°W, dip: 75°NE) from the southern slope of way point 36 to the middle of way point 68 and 69. The width maintains 3~7m up to way point 40 and changes to 15~50m up to way point 47 and then to 1~5m at the end of its length.

From this point, the secondary quartz vein has not developed any more and gray andesite is solely distributed up to way point 72.

Photo 8-5 Pithole at Way Point 27

Photo 8-6 Outcrop at Sampling Spot 27

Photo 8-7 Quartz Veinlet at Way Point 32

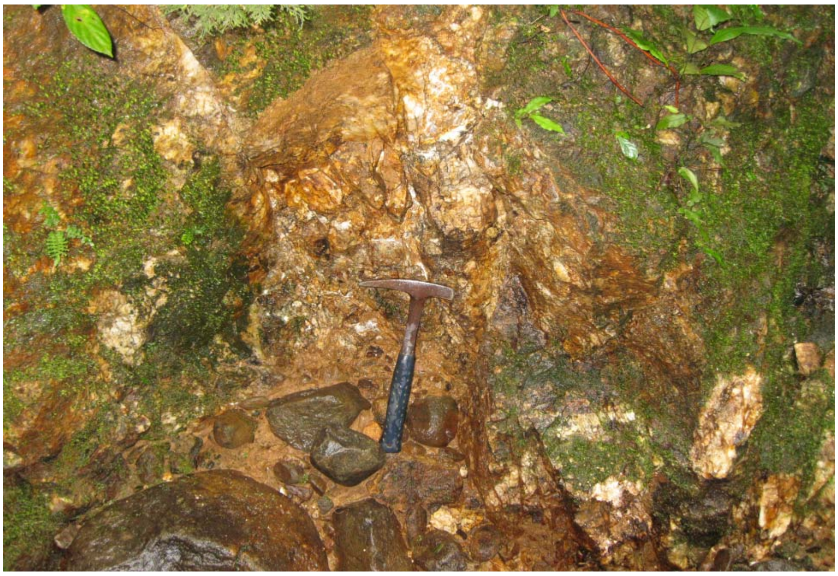


Photo 8-8 Felsite Intrusion near Way Point 46

Photo 8-9 Horizontal Pithole at Way Point 52
(Northern Valley)

Photo 8-10 Vertical Pithole at Way Point 52
(Southern Valley)

○ Sabeta Kecil Stream Area

Sabeta Kecil stream, running from east to west and almost horizontal to Sabeta stream, joins with Ngelewar stream at about the 30m spot from the entry of Sabeta stream.

The Tuff Formation contacts with the Gosowong Formation near the sampling spot KR1-3. A large quartz vein was not found, but veinlets appear intermittently(Photo 8-11).

According to the analysis result of 3 samples, collected from the contact zone of quartz veinlets and wall rock, Au contents turned out to be 0.16ppm, 0.09ppm, and 0.05ppm, respectively(Table 8-11). There is no gold ore vein, but it is quite certain that weak gold mineralization has occurred.

Table 8-11 Analysis Result of Ore Samples in Sabeta Kecil Stream

(unit: ppm)

Location No.	Sample No.	Au	Cu	Ag	Mn	Hg	As	Sb
KR1-1	KR-1	0.16	111	<1	342	0.07	29	3
KR1-2	KR-2	0.09	74	<1	822	0.03	6	3
KR1-3	KR-3	0.05	18	3	140	0.03	5	<1

Photo 8-11 Quartz Veinlet at Sabeta Kecil Stream

8.2.3 Result Analysis

As the result of detailed surface geological survey in Sabeta area, the gold-bearing quartz veins, observed in the surface along with previous pitholes and trenches, take on various patterns such as a single and tributary vein along with horizontal and stockwork veinlets.

The main and secondary quartz vein, developed along the NS slope in Sabeta stream turned out to be massive one(width: 1~70m, length: over 1,200m).

Based on the analysis of 40 samples from these quartz veins, 10 samples recorded Au content higher than 8ppm and this signifies these veins are gold deposits.

More detailed information on the deposit development and sample analysis will be provided in Chapter 9.

9. DEPOSIT AND RESERVES

9.1 Deposit

9.1.1 Overview

According to the result of regional and detailed geological survey in the mine lots, the gold-bearing quartz vein deposit, found by the detailed surface geological survey in Sabeta area, contains profitable high grade of Au.
If the survey continues, metal minerals including Ag and Cu might be well detected.

Also, signs of gold mineralization were observed in several areas except for Sabeta area, their original mineralized zone and deposit should be swiftly searched for.

9.1.2 Situation of Sabeta Gold Deposit

From the northern slope of way point 4 to the northern slope of way point 39 of the gold-bearing quartz vein deposit in the route map of Sabeta area is designated as the main quartz vein(width: 5～70m, length: about 700m) as shown in Table 9-1.

In addition, a gold-bearing quartz vein, which is cut by the main quartz vein in the southern slope of way point 36, is viewed as the secondary quartz vein. This secondary vein is extended to the northern slope between way point 68 and 69. Its length is around 600m and its width is 1～50m (Table 9-1).

Table 9-1 Situation of Sabeta Gold Deposit

Vein	Length(m)	Width(m)	Strike	Dip
Main Quartz Vein	700	5.0～70	N40°～80°W	65°～85°NE
Secondary Quartz Vein	600	1.0～50	N50°～70°W	70°～85°NE

The strike and dip of the main and secondary quartz vein are N40°～80°W and 65°～85°NE and N50°～70°W and 70°～85°NE, respectively.

9.1.3 Sample Analysis Result of Sabeta Gold Deposit

The analysis result of 40 samples were collected from the main and secondary quartz vein is illustrated in the following Table 9-2.

Table 9-2 Analysis Result of Ore Samples in Sabeta Area (unit: ppm)

Sample No.	Way Point	Au	Cu	Ag	Mn	Hg	As	b
SR-1	13~14	0.25	273	<1	434	0.05	12	2
SR-2	15	0.02	45	<1	222	0.20	7	2
SR-3	17~18	0.02	61	<1	386	0.04	25	1
SR-4	18~19	0.02	35	1	259	0.05	15	3
SR-5	Southern Slope of 20	0.02	22	<1	68	0.08	47	1
SR-6	Southern Slope of 21	0.05	54	<1	450	0.03	47	2
SR-7	Southern Slope of 22	0.01	64	<1	268	0.01	17	2
SR-8	Southern Slope of 22	0.02	46	1	276	0.05	24	1
SR-9	22~23	0.03	79	<1	2710	0.15	10	3
SR-10	26~27	0.08	28	<1	317	0.04	37	1
SR-11	29~30	<0.01	82	1	1080	<0.01	3	1
SR-12	31~32	0.06	47	<1	985	0.01	9	3
SR-13	Southern Slope of 34	0.20	48	4	210	0.12	9	3
SR-14	Southern Slope of 33	20.60	36	22	93	0.02	10	2
SR-15	Southern Slope of 36	0.41	98	1	846	0.10	19	2
SR-16	Southern Slope of 36	0.03	89	<1	1030	0.03	16	2
SR-27	Southern Slope of 30	16.70	43	8	220	0.08	3	1
SR-28	Southern Slope of 21	8.67	100	6	854	0.02	3	3
SR-29	Southern Slope of 21	0.11	20	<1	240	0.02	7	4
SR-30	13~14	0.08	15	2	199	0.05	13	2
SR-31	13~14	13.65	112	18	325	0.11	6	2
SR-32	13~14	22.45	210	17	342	0.01	9	2
SR-33	Near the South of 21	10.40	48	5	196	0.08	38	<1
SR-34	22~23	0.06	86	<1	2370	0.12	6	<1
SR-35	28	0.03	40	<1	613	0.04	18	1
SR-36	Southern Slope of 33	0.05	88	<1	813	0.09	9	<1
SR-17	Southern Slope of 37	0.02	169	1	173	0.06	3	2
SR-18	Southern Slope of 40	0.67	66	<1	341	0.20	2	2

SR-19	42	0.05	110	<1	264	0.09	2	1
SR-20	Northern Slope of 44	0.02	17	<1	92	0.07	6	3
SR-21	Southern Slope of 45	0.27	35	1	84	0.43	19	3
SR-22	52~53	26.20	87	30	344	0.07	22	3
SR-23	Southern Slope of 59	0.36	54	<1	76	0.71	6	3
SR-24	Southern Slope of 60	0.07	61	3	81	0.27	18	3
SR-25	61~62	58.00	40	5	81	0.23	2	4
SR-26	62	19.00	77	11	44	0.01	5	1
SR-37	Southern Slope of 40	18.50	65	16	244	0.01	6	2
SR-38	41~42	0.05	76	<1	271	0.07	3	1
SR-39	53	0.09	53	<1	605	0.05	27	2
SR-40	Southern Slope of 67	0.03	38	1	227	0.19	8	1

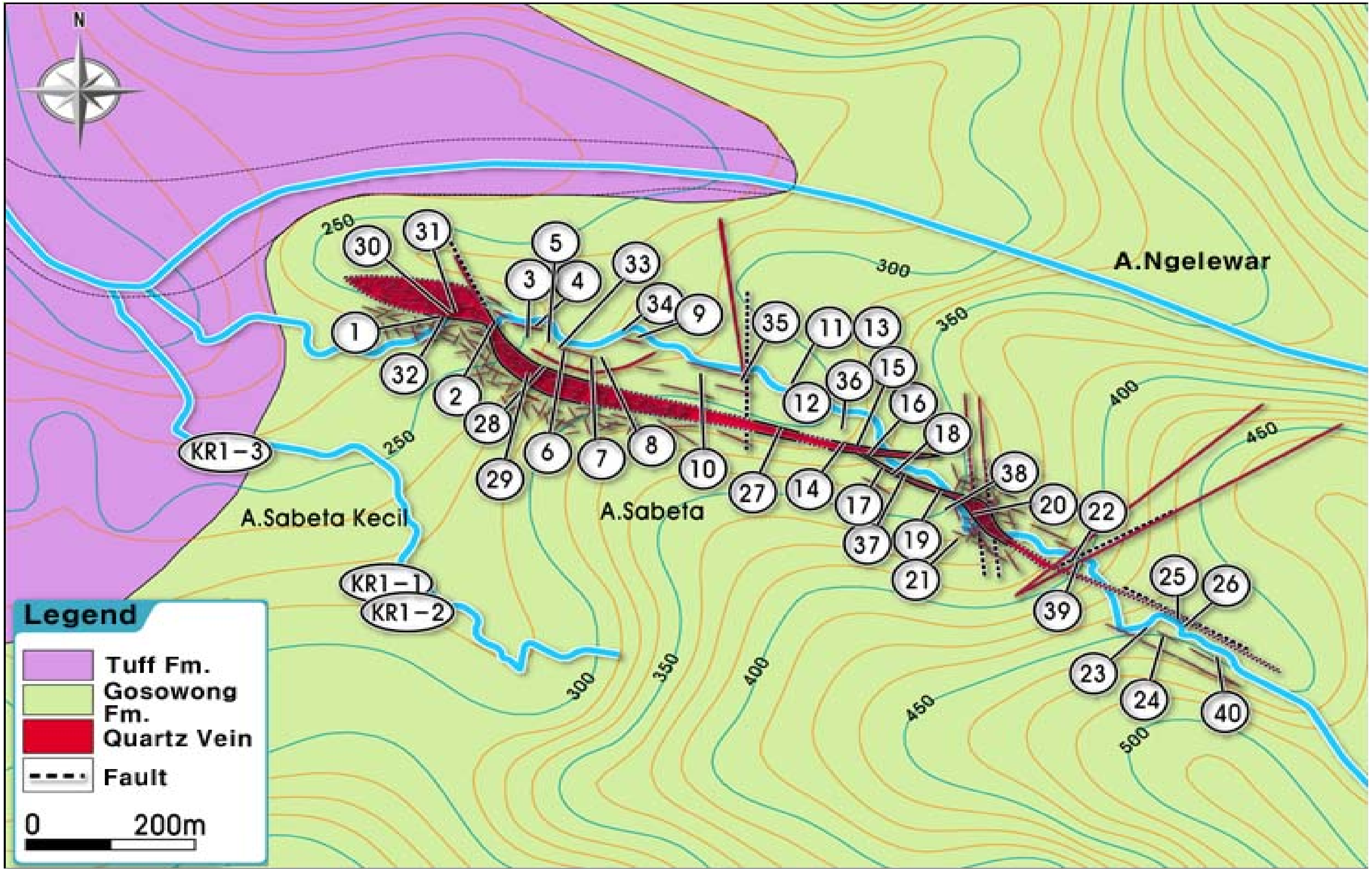


Figure 9-1 Sampling Location of Ore Samples in Sabeta Area

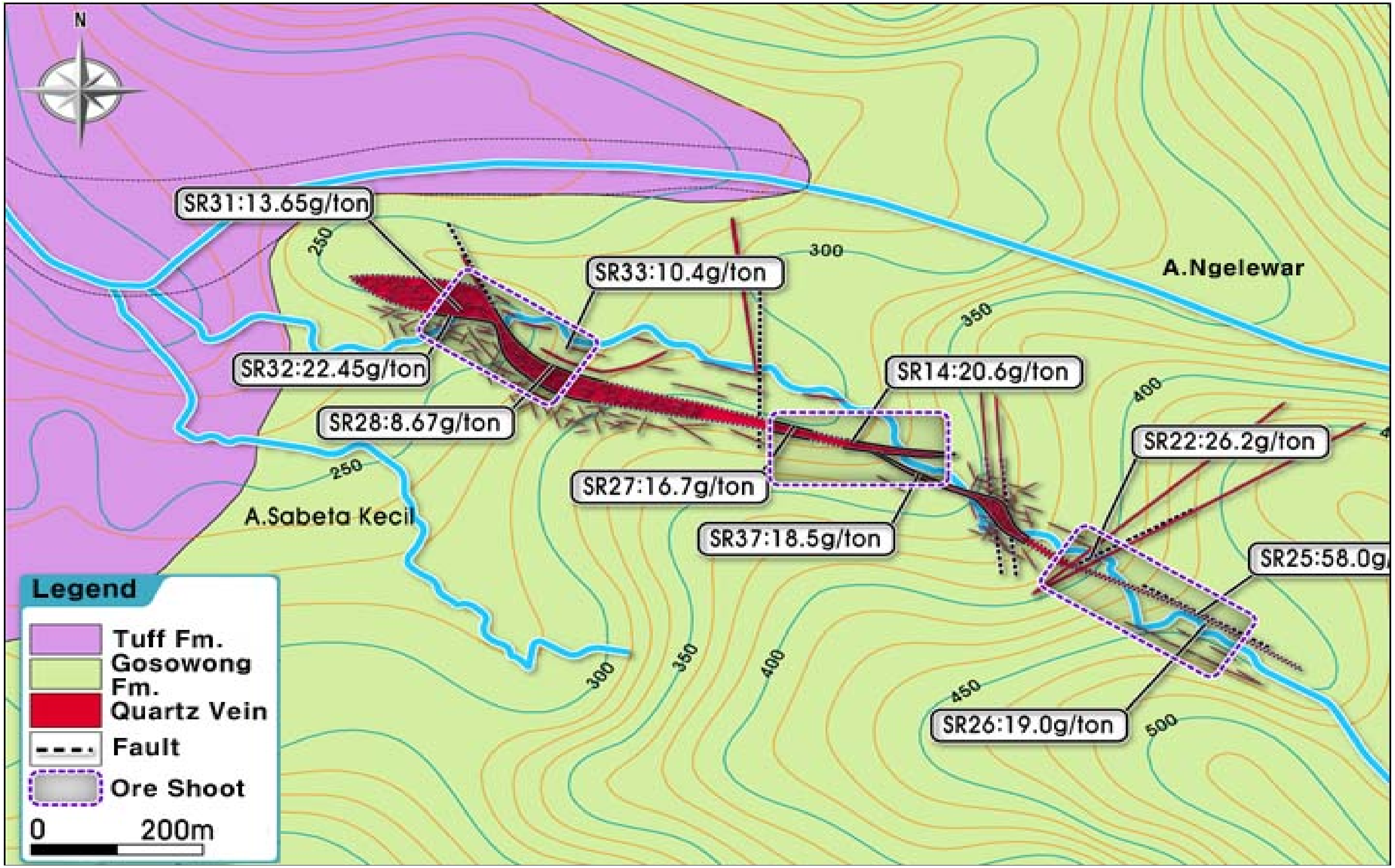


Figure 9-2 Analysis Result of Ore Samples in Sabeta Area

The analysis result of 26 samples from the main quartz vein contained Au<0.01～22.45ppm and Ag<1～22.00ppm.

Economic grade Au was detected from ore samples in Sabeta area; sample SR-32(Au 22.45ppm) and SR-31(Au 13.65ppm) in Sabeta stream valley between way point 13 and 14, SR-28(Au 8.67ppm) in the southern slope of way point 21, SR-33(Au 10.4ppm) in the alteration zone containing a quartz veinlet near the south part of way point 21, SR-27(Au 16.7ppm) in the southern slope of way point 30, and SR-14(Au 20.60ppm) in the southern slope of way point 33.

The remaining 20 samples held Au 0.01～0.41ppm except for 1 sample(Au <0.01ppm) and thus the main quartz vein is gold mineralized as a whole.

In addition, 14 samples from the secondary quartz vein displayed Au 0.02～58.00ppm and Ag <1～30.00ppm.

Sample R-37(Au 18.50ppm) in the southern slope of way point 40, SR-22(Au 26.20ppm) at way point 52～53, SR-25(Au 58.00pm) at way point 61～62, and SR-26(Au 19.00ppm) at way point 62 turned out to hold profitable Au content.

Other 10 samples also contained Au 0.02～0.67ppm and this supports the gold mineralization of secondary quartz vein.

In addition, As and Sb content registered 13.7ppm and 2.08ppm respectively, and these figures are relatively higher than the Clarke number along with the average content of andesite. This also backs up the gold mineralization in this area(Table 9-3).

Table 9-3 Average Content of As and Sb Based on Volcanic Rock Type

(unit: ppm)

Element	Sabeta Area	Basalt	Andesite	Rhyolite	Clarke Number
As	13.07	0.8	1.8	3.5	1.8
Sb	2.08	0.1～1.4	0.2	0.1～0.6	0.2

9.1.4 Factors for Sabeta Gold Deposit

○ **Intrusive Rocks**

Thin or small-scale felsite veins and porphyritic intrusive rocks have intruded the Gosowong and Tuff Formation throughout the mine lots. Felsite is chiefly composed of adularia and quartz, and porphyritic intrusive rocks are of diorite along with the phenocryst of plagioclase, magnetite, and quartz.

No large intrusive rock body has been found in the mine lots, up to the present. Hence, the mineralization is assumed to coincide with the dioritic stock intrusive rock body of NHM mine, about 10km distant in the SE direction from this area. Nonetheless, it is still possible that an unexposed large intrusive rock body exists in this area.

In late Miocene(Cenozoic), andesitic volcanic rocks have erupted to extensively cover the existing soil layers. Then, NS, NE, and NW-directed fault movement has occurred and led the Tuff Formation(Pleistocene) to cover the upper layer.

At the same time with or shortly after the fault movement, a series of intrusive rocks including quartz, felsitic, dioritic, and andesitic veins intruded along the fault and subfault.

○ **Hyperthermal Alteration**

Paleo-weathering in the mine lots has caused hematite alteration and regional granular andesitic alteration, going with regional metamorphism, and repeated hyperthermal alteration in the existing andesitic volcanic rocks followed.

Then, the repeated hyperthermal alteration has brought an epithermal quartz vein and the post-mineralization has occurred with a subfault.

Mineral composition of alteration is influenced by nearby rocks and reflects wall rock. Main alteration in this area is silification and quartz, chalcedony, adularia, and pyrite are easily observed.

○ **Mineralization**

Low sulfidation epithermal vein-typed mineralization took place and thus well developed stockwork quartz veins at or near an alteration zone are easily discovered in Sabeta gold deposit. Veins are 1-20mm thick with the density of 10～100 veins per meter. They are pale to dark gray and locally contain fine granular sulfide minerals along open-centered cavities or vein boundaries. Disseminated and fractured mineralization are scarcely observed.

In specific, the relevant mineralization occurred in the formation of various quartz vein structures from breccia, including wall rock and quartz vein clasts, to stockwork or sheeted veins, fracture fill, cavity fill or clasts within a fault. Veins include a variety of sulfide minerals inclusive of quartz, adularia, gold, clay, chalcedony, chlorite, hematitie, and pyrite. Textures of quartz vein are bladed, crystalline, cockade, colloform, comb, drusy, vuggy, crustiform, cryptocrystalline, massive, moss and saccharoidal. Crystalline quartz, one of vein phases in Sabeta area, forms quartz stockwork. Minerals of quartz stockwork are open-space quartz crystals, chalcedony, calcite, quartz, and clay. This phase generally contains low grade of gold.

Banded quartz-adularia is the largest mineralization in terms of scope. A main feature of this phase is a white crustiform and colloform-banded quartz vein and breccia with a dark and fine granular sulfide mineral zone. This phase typically contains mid to high grade of gold. Its geochemical feature is associated with Au, Ag, Pb, Sb, and Cu. The wavy crustiform zone, rich adularia, and platy calcite pseudomorph indicate that this type of mineralization occurred through the boiling of hyperthermal fluid at the shallow part.

Banded quartz-chlorite is small-scale, but contains highest grade of gold. This phase is typically developed as a fine granular zone and boundary around quartz veins and fragments. And this phase consists of colloform

-banded quartz, sulfide minerals, gold, chlorite, and green clay. This is more prevalent in the core of mineralization, but also appears in a re-activated quartz vein.

Au 26.20ppm(sample SR22) in the N50°E-directed split quartz vein at way point 52～53 and Au 58.00ppm(sample SR25) at way point 61～62 were checked and these are considered to be quartz-chlorite phases.

Sulfide silica is regarded as the last phase of mineralization. It is composed of interstitial, poorly crystalline, and ultra fine granular molybdenite along with a little amount of pyrite formed along the late staged shear zone and fracture and filling cavities. This phase generally contains mid to high grade of gold.

Most of the Sabeta gold deposit shows a crystalline quartz and banded quartz-adularia phase. Outcrops of this deposit are situated in 200m higher than that of NHM's mine and thus a quartz-chlorite phase is expected to exist in the deep part.

○ **Geological Structure**

A massive quartz vein intruded along the NWW-directed fault in Sabeta area. Simultaneously, the infiltration of gold-bearing ore solution, that is hyperthermal water, formed an alteration zone in andesite(wall rock of this vein) and caused mineralization in the quartz vein and alteration zone.

As a consequence, the gold deposit in Sabeta area was formed. And then, the fault, containing the secondary quartz vein(strike: N50°～70°W) developed and this was followed by the development of the fault holding the main quartz vein(strike: N40°～80°W). The latter fault cross-cut the former fault. Also, the N-NNW-NNE-directed subfault developed and the gold mineralization occurred in some parts of this fault.

Low sulfidation epithermal gold mineralization occurred in shoots, created along sites where quartz vein-filled faults or fractured structures are extended. Faulting and fracturing in this area is complicated and widespread with multiple structural orientations and fault generations.

Main structural directions are NW, N, and NE. Except for the N direction, they are similar to the dominant orientations of lineal structures in the mine lots.

The structural system in Sabeta area is characterized by i) relatively wide area and steep dip; and ii) the NS-directed massive quartz vein. The main and secondary quartz vein are NE-directed with the steep dip of subverticality.

○ **Deposit Type**

The gold mineralization generated low sulfidation epithermal gold deposits, hosted by Tertiary andesitic and volcanic rocks in Sabeta area. Gold is contained in quartz vein structures and these structures vary from general veins to breccia zones, containing both wall rock and quartz vein clasts, to stockwork or sheeted veins, to fractured fill, cavity fill or clasts within a fault. 4 types of quartz veins, such as crystalline, quartz, banded quartz-adularia, and banded quartz-chlorite, and sulfidic silica, host the gold mineralization.

9.2 Reserves

9.2.1 Overview

Trenching, drilling, and tunnelling in the gold deposit of Sabeta area are not carried out yet and thus probable and proved reserves cannot be provided at this stage.

The deposit was found only in the surface from the detailed surface geological survey and the development situation of deposit was partly checked since ore samples were collected only from the surface. Therefore, possible reserves was calculated in this chapter so as to establish the aims and directions of later survey.

Although there were signs of deposits in other areas including Tarusi and Donghar area, their existence was not checked in this survey. Concerning these areas, an additional survey should be conducted to figure out their reserves.

With respect to metal elements such as Ag, Cu, Mn, Hg, As, and Sb, their reserves was not calculated since their economic grade was not detected in this survey.

9.2.2 Calculating Reserves

O Basis

- Average Grade: 5.4ppm(arithmetic mean); this is based on the analysis result of 40 ore samples from Sabeta gold deposit.
  *217.36 ppm/40 Ore Samples = 5.434ppm
- Vein Width: 15m(arithmetic mean); vein width was not checked by trenching and drilling, but this value was calculated, relied on the result from the detailed surface geological survey.
- Length: 1,200m; overall length 1,300m(main vein 700m+secondary vein 600m) was obtained from the detailed surface geological survey. But 100m, that is the unclear and overlapped part with the fault, was excluded.
- Existence Depth: 300m; the site between sample 1(elevation: 250m) and sample 40(elevation: 450m) in Sabeta deposit can be developed through horizontal tunnelling. In addition, Sabeta deposit is expected to develop from maximum 250m(above sea level) to minimum -50m(below sea level) and in case of the Kencana mine of NHM, the probable reserves was calculated by considering -150m. Based on this, the existence depth is set as 300m.
- Specific Gravity: 2.3; this is based on the specific gravity of andesite(wall rock), quartz vein, and gold.

- Growth Degree: 1.03; average dip of the main+secondary vein = 76° and then cosec 76°=1.03(≒1.0306) is set as growth degree.

- Existence Rate: 50%; this is based on soil surface along with the progress of survey and the development of deposit.

○ Reserves of Sabeta Gold Deposit

According to the above bases and KS E 2001, the possible reserves of Sabeta deposit is calculated to be Au 8.35 million ton and of metal is 45.09 ton(Table 9-4 and Figure 9-3).

Table 9-4 Reserve Calculation of Sabeta Gold Deposit

	Width (m)	Length (m)	Height (m)	Existence Depth (m)	Specific Gravity	Growth Degree (csc 76°)	Existence Rate (%)	Possible Reserves (t)
Estimation	15	1,200	450 ~ 250	Cross Sectional Area (㎡): 110,000	2.3	1.03	50	1,954,000
			250 ~ -50	300				6,396,000
Total								8,350,000

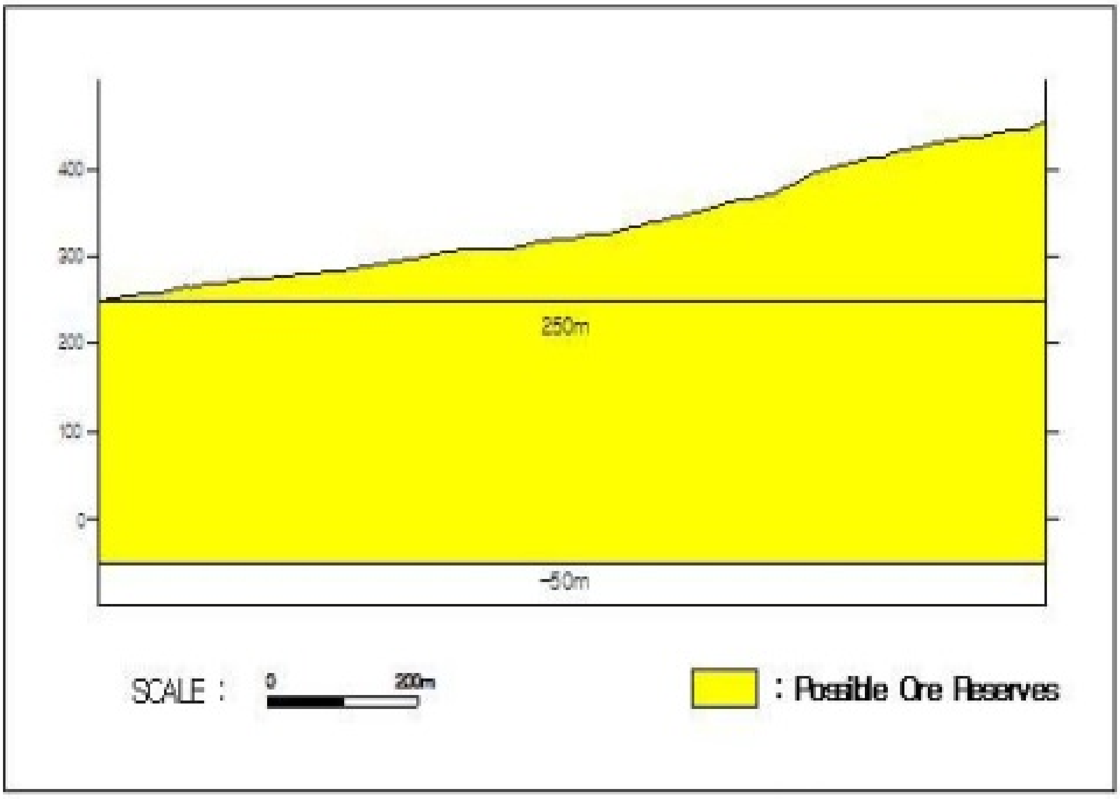


Figure 9-3 Reserve Calculation of Sabeta Gold Deposit

10. FUTURE SURVEY PLAN

10.1 Overview

The overall geological distribution and deposit development on the related mine lots could be understood through the regional and detailed geological survey.

Based on the anomaly points and zones which were detected in this survey, it is required to find the original blind mineralized zones or deposits and to check their scope and grade for the next survey. In addition, concerning the deposits, detected only from the surface in this survey, their development in the deep part should be checked to establish a more concrete survey plan.

With respect to the observed mineralized outcrops in this survey, the detailed surface geological survey should be performed in order to fully understand their development situation.

Trenching would be firstly necessary to explore the geochemical anomaly zones and the original mineralized zones and deposits of anomaly points with high grade of gold. If this does not bring satisfactory result, physical exploration can be considered. Trenching might be required for anomaly zones with low grade of gold in the future, too.

Drilling in an adequate interval and depth would be conducted along the extension of outcrops from the detected gold deposits in the surface.

10.2 Survey Plan

10.2.1 Detailed Surface Geological Survey

As checked by the basic surface geological survey out of the regional geological survey, the quartz vein is developed in upper Ngibut stream(east of Zone 1) and the analysis result of 3 samples from this site indicated that sample LR-2 contained Au 2.81ppm. This is the only spot with Au content higher than the anomaly standard, except for Sabeta area(Zone 2). The detailed surface geological survey is necessary in the nearby region to understand the development situation of the quartz vein.

10.2.2 Detailed Geochemical Survey

As explained in chapter 8, 4 alluvial gold particles at sample S2-11 and 5 alluvial gold particles at sample S2-12 were observed from the heavy mineral stream concentrate survey out of regional geochemical survey in Sosam stream(Zone 2). Therefore, the detailed(or soil) geochemical survey is required at the related site including this spot, along the upper watershed toward lower Sosam stream.

Au 0.16ppm was detected at sample S5-3 from the stream sediment survey out of regional geochemical survey in Awiri stream(Zone 5). This was the second highest Au content in the stream sediment survey. Hence, it is necessary for the detailed geochemical survey at the related site including this spot along the upper watershed toward lower Awiri stream.

10.2.3 Trenching

Tarusi Area

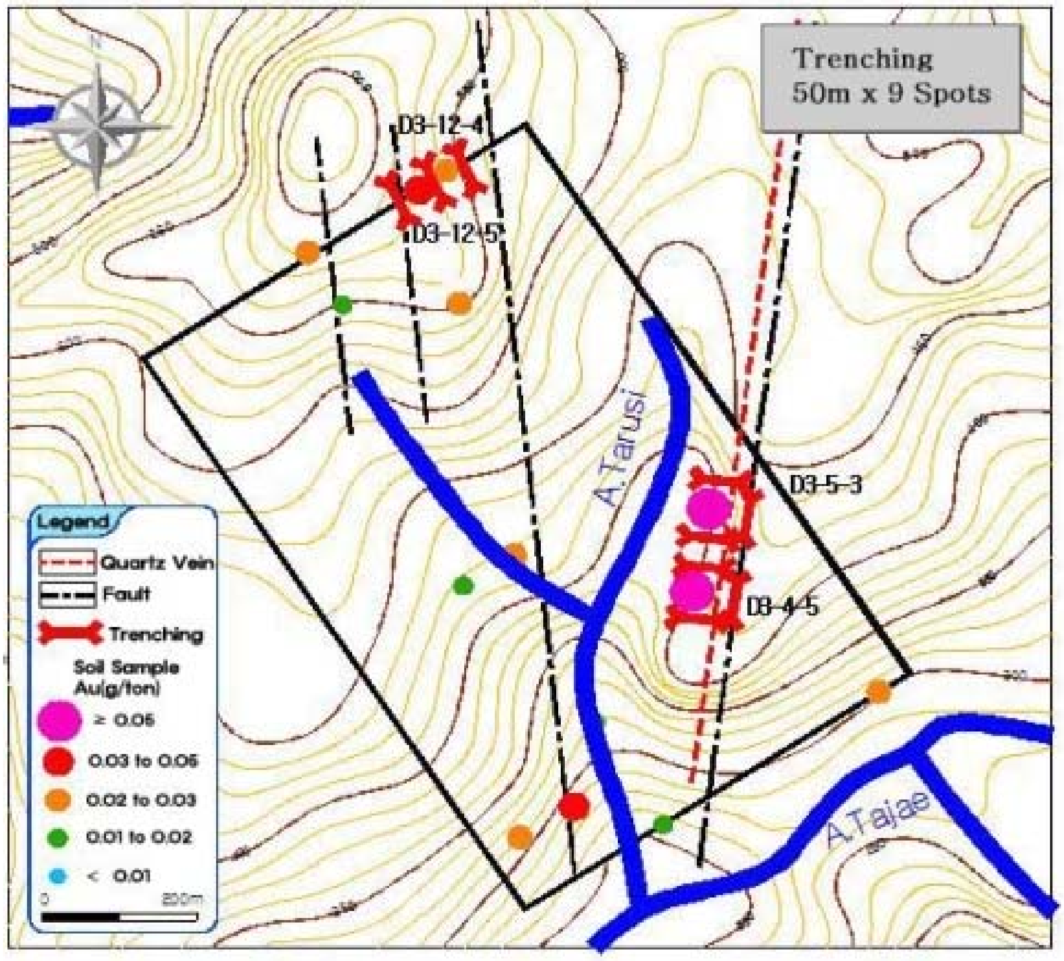


Figure 10-1 Trenching Plan in Tarusi Area

Based on the result of detailed geochemical survey, trenching for 9 spots(6 for the anomaly zone regarding soil samples D3-4-5 & D3-5-3 and 3 for the anomaly zone concerning soil samples D3-12-4 & D3-12-5) is necessary in Tarusi area(Zone 2), as shown in Figure 10-1.

In regards to Sabeta area(Zone 2), only 6 anomaly points were found with no anomaly zone, according to the detailed geochemical survey. Among these points, D4-2-14, D4-5-5, and D4-6-1 are laid out in the almost same line with the similar orientation from upper to lower Donghar stream. Above all, these three samples showed Au 3.3~6.6 times higher than the anomaly standard. Hence, trenching for 8 spots is required for this area; in specific, 6 for the upper and lower level of these 3 samples plus 2 for the upper and lower level of D4-1-6(Figure 10-2).

Trenches are designed in a standard of 50m(length), 1.0m(width), and 1.5m(depth), but their standard should be adjusted based on the actual situation. However, their bottom should be dug up to the C layer where the bed rock is piled up at the same spot without any movement. Also, samples should be collected from the B and C layer and if possible, from the bed rock.

The total trench job area is 50 × 1.0 × 1.5 × 17 = 1,275(㎥).

Donghar Area

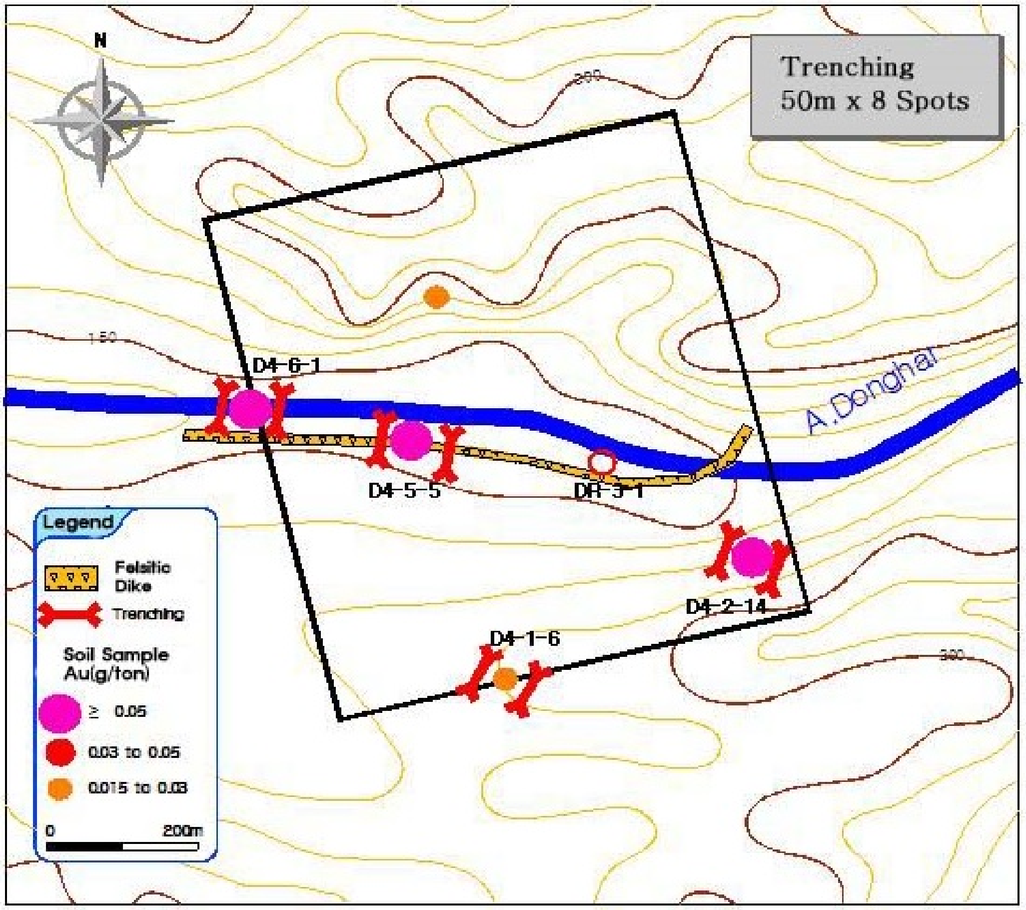


Figure 10-2 Trenching Plan in Donghar Area

10.2.4 Drilling

The gold-bearing quartz vein in Sabeta area(Zone 2) is the only deposit, whose scope and grade are presently identified in the mine lots. Nonetheless, this deposit is checked only from the surface and thus in order to grasp its development situation(particularly, in the deep part) and its economic reserves, a total depth of 3,000m drilling for 15 boreholes(depth: 200m, interval: 60m, dip: 60°) for the relevant area is recommended(Figure 10-3). However, actual depth, interval, and dip will be adjusted, based on the progress of drilling.

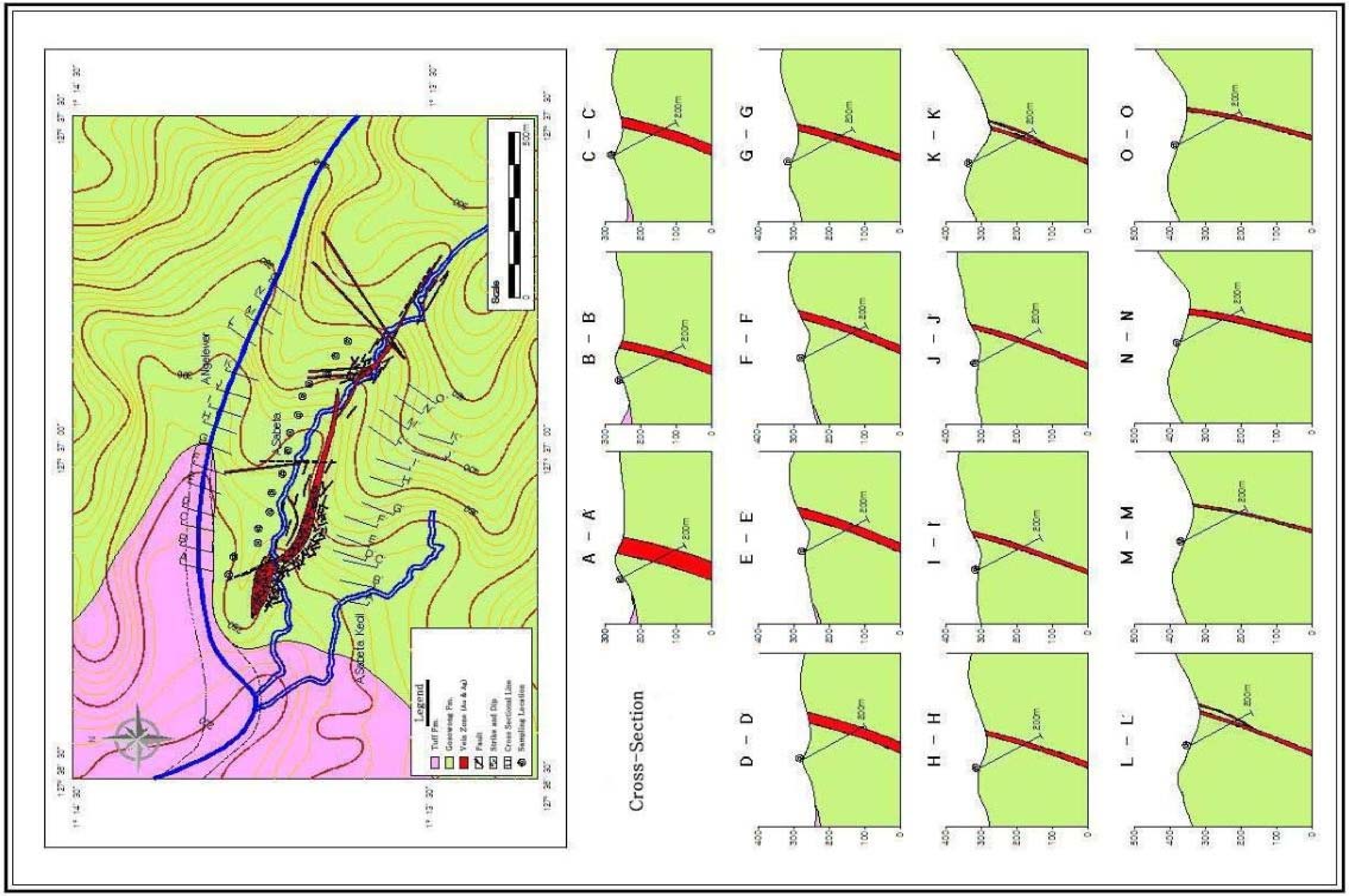


Figure 10-3 Drilling Plan Map

10.2.5 Summary

Table 10-1 comprehensively describes on the future survey plan. These are the priority jobs, which should be done immediately.

Table 10-1 Overall Survey Plan

Survey	Zone	Area	Survey Plan	Purpose
Detailed Surface Geochemical Survey	1	Ngibut	Detailed surface geological survey over the outcrops of quartz vein where ore samples LR-2 was collected(upper Ngibut stream)	Checking development situation of gold-bearing quartz vein
Detailed Geochemical Survey	2	Sosam	Detailed geochemical survey over the area of heavy mineral stream concentrate samples S2-11 and S2-12 spot from the upper watershed to the lower stream	Confirming Au anomaly points and zones
	5	Awiri	Detailed geochemical survey over the area of stream sediment sample S5-3 spot from the upper to the lower stream	Confirming Au anomaly points and zones
Trenching	3	Tarusi	Trenching for 9 spots(total length 450m); 6 for anomaly zones of soil samples D3-4-5 & D3-5-3 and 3 for anomaly zones of soil samples D3-12-4 & D3-12-5	Confirming gold-bearing quartz vein
	3	Donghar	Trenching for 8 spots for soil samples D4-1-6, D4-2-14, D4-5-5, & D4-6-1(respective 2 samples from the upper and lower level of these sample spots, total length 400m)	Confirming gold-bearing quartz vein
Drilling	2	Sabeta	Drilling for 15 boreholes(depth: 200m, total depth: 3,000m) in Sabeta gold deposit	Checking the development situation of deep deposit

11. CONCLUDING REMARKS

- This report is prepared by K&I's geological survey team, based on the result of deposit survey over the 1 year period(January 2012～January 2013) and sample analysis on its mine lots(practically owned by K&I's Indonesian subsidiary, PT. ORO KNI) in Indonesia.

- The registered mine lots are situated in South Ibu and Jailolo, West Halmahera, North Maluku, Indonesia, with No. 98 and 99 permit. The relevant KP was obtained in April, 2007 and this was changed to IUP in August, 2010.

- In specific, the geological deposit survey targets the area of 14,000ha and this area is categorized into 5 zones. First, the basic surface geological survey and regional geochemical survey, out of regional geological survey, were carried out and then the detailed chemical survey and detailed surface geological survey, out of detailed geological survey, were performed on the mineralization prospective spots, based on the regional geological survey.

- In regards to the geological features of the survey region, the Gosowong Formation(Upper Miocene, Tertiary period), the Kayasa Formation(Pliocene, Tertiary period), the Tuff Formation(Pleistocene, Quaternary period), and the volcanic rocks and alluvium(Holocene), which are presently active. Gold deposits are situated in andesitic rocks of the Gosowong Formation.

- According to the result of regional geochemical survey, 4 Au anomaly points in stream sediment samples and 5 Au anomaly points in heavy mineral stream concentrate samples were found. Regarding the basic surface geological survey, 1 small outcrop of gold-bearing quartz vein and 1 large gold-bearing quartz vein were observed, respectively.

- In terms of the detailed geological survey, which were carried out on the prospective spots from the regional geological survey, Tarusi area(Zone 3) contained 2 Au anomaly zones and 10 anomaly points and Donghar area(Zone 3) held 5 Au anomaly points, based on the soil geochemical survey. Besides, a gold-bearing quartz deposit(average vein width: 15m, average Au grade: 5.4ppm, length: 1,200m) were identified from the detailed surface geological survey in Sabeta area(Zone 2).

- Hydrothermal alteration, occurred repeatedly with silification in Sabeta area, formed quartz vein structures and the Sabeta deposit was produced in the structures by the mineralization in the process of making a low sulfidation epithermal vein.

- The Sabeta deposit largely shows a crystalline quartz and banded quartz-adularia phase. Outcrops of this deposit are located about 200m higher than those of NHM's mine and hence a quartz-chlorite phase is expected to exist in the deep part of the deposit.

- The possible gold ore reserves in Sabeta deposit is expected to be 8.35 million ton and the possible metal reserves is 45.09 ton.

- The detailed surface geological survey for Ngibut area(Zone 1) and the detailed geochemical survey for Sosam area(Zone 2) and Awiri area(Zone 5) are firstly planned. These are prospective areas, according to the regional geological survey. 17 spots where the geochemical anomalies were detected from the detailed geological survey in Tarusi and Donghar area(Zone 3) are required for a length of 850m trenching. Also, 15 boreholes and drilling(depth: 3,000m) are planned to understand the development situation of deep part in Sabeta area.

- The related mine lots are located in the neighborhood of the highest grade epithermal gold field across the world. Therefore, if more advanced staff and technology are employed in the future geological deposit survey, there is a very strong possibility of satisfactory result.

ACKNOWLEDGEMENTS

First, I would like to express my gratitude to Mr. Jun, Yong Kon, chairman of K&I, for fully supporting the survey team to conduct the related field exploration in Indonesia.

I am also thankful to Mr. Seo, Dong Yeon, manager of PT. ORO KNI, 3 external geologists, and Indonesian porters for their hard work and sincere cooperation throughout the survey.

Dr. Seo, Jeong Ryul and Dr. Lee, Jin Soo at Korea Institute of Geoscience and Mineral Resources are much appreciated for their kind tips and opinions to complete this survey report, too.

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Senior Geologist and Management Advisor
K&I International Co., Ltd.

REFERENCES

AMC Mining Consultants Ltd.(Canada), 2012, Technical Report on the Gosowong Property in North Maluku Province in Indonesia, Newcrest Mining Ltd.

Chang Sung Kim, et. al., 2002, Hydrothermal Alteration and Its Genetic Implication in the Casado Volcanic-hosted Epithermal Cold-Silver Deposit: Use in Exploration, The Mineralogical Society of Korea

Chung Ryul Ryoo, 2000, Metal Deposit and Its Structure in Indonesia The Geological Society of Korea, p.59

Chung Ryul Ryoo, 2000, Possibility of Deposit Exploration by Utilizing Water System or Lineation in Indonesia, The Korea Earth Science Society

Evensen, N.m., Hamilton, P.J. and O'Nions, R.K., 1978, Rare Earth Abundances in Chondritic Meteorites. Geochim. Cosmochim. Acta., v. 42, pp.1199-1212.

Fateh Chand et al., 1981, A Manual of Geochemical Exploration Methods, pp.2:1-2:22, Geological Survey Malaysia

Geological Map of the Morotai Quadrangle, North Maluku, 1980, Geological Research and Development Centre of Indonesia

G.R. Davey et al., 1997, Discovery of The Gosowong Epithermal Quartz-Adularia Vein Deposit, Halmahera, Eastern Indonesia, Newcrest Mining Ltd.

Hamilton, W., 1979, Tectonic of the Indonesian Region, USGS Professor Paper, v.1078, p.346

Hedenquist, J.W., Arribas, R.A. and Gonzalez, U.E., 2000, Exploration for Epithermal Gold Deposits

Hyo Taek Jeon et al., 1993, Applied Geochemistry, Seoul National University Press

In Joon Kim et. al., 2004, Soil Geochemical Exploration of the Mt. Subang Area of the Southern Part of the Bandung, Indonesia, Economic and Environmental Geology, vol. 37, pp.173-184

In Joon Kim et. al., 2004, The Present State of the Metal and Gold Deposits in Indonesia, Economic and Environmental Geology, vol. 37, pp.269-276

In Joon Kim and Jae Ho Lee, 2006, Geochemical Exploration on Stream Sediments of Tumbang Mirih Area of the Middle Kalimantan, Indonesia, Economic and Environmental Geology, vol. 39, pp.301-328

In Woo Lee et. al., 2000, Detailed Survey Report (Gold: Jindo District), Korea Resource Corporation

In Woo Lee et. al., 2002, Detailed Survey Report (Metal Deposit: Haenam, Umsung, and Pocheon District), Korea Resource Corporation

Jong Hwan Kim et. al, 1990, Studies of Volcanogenic Epithermal Mineralization and Modeling (I), Korea Institute of Geoscience and Mineral Resources

Jong Hwan Kim et. al, 1990, Study of Volcanogenic Epithermal Mineralization and Modeling (Ⅲ), Korea Institute of Geoscience and Mineral Resources

Laurence Robb, 2004, Introduction to Ore-Forming Processes, pp.117-119

Lindgren, W., 1933, Mineral Deposits, 4th ed.: New York, McGraw-Hill, p.930

Newcrest Mining Ltd., 2011, Newcrest Mining Annual Report 2011

Noel C. White, 1995, Epithermal Gold Deposits: Styles, Characteristics and Exploration

P.T. Nusa Halmahera Minerals, 1999, Laporan Tahun 1998 Tahapan Eksplorasi Halmahera, Maluku Utara

R. Hall, 1988, Late Palaeogene-Quaternary Geology of Halmahera, Eastern Indonesia of Volcanic Island Arc

Sang Hoon, Choi, 2000, Study of Metallogenic Modelling on Domestic Gold-Silver Deposits, vol. 2000-2, Korea Resource Corporation

Sang Hoon Choi and Sung Joon Yeom, 1999, Study of Metallogenic Modelling on Domestic Gold-Silver Deposits, vol. 99-2, Korea Resource Corporation Korea Resource Corporation

Sang Mo Koh, Jung Kwon Park, and Hyeung Jae Lee, 1992, Survey on Gasado Altered Zone: Studies of Volcanogenic Epithermal Mineralization and Modelling (III), Ministry of Science of Technology

Sunarya, Y and Bache, J.J., 1987, Epithermal Gold Mineralization in Indonesia, a Synthesis Areas of Potential for Gold, Directorate of Mineral Resources

Sunarya, Y., 1989 Overview of Gold Exploration and Exploitation in Indonesia. Indonesian Association of Geology Journal

USGS, 2012, Mineral Commodity Summaries 2012 Year Book

APPENDICES

[Cover Page] Sample Analysis Test Report(INTERTEK)

[Photo 1] Field Survey of K&I Survey Team

[Photo 2] Field Survey of IRGMRSHP Team

[Cover Page]

Sample Analysis Test Report(INTERTEK)

Intertek

TEST REPORT

Park Hyung Ho
PT. Oro Kni
Jl. Inpres 321 RT.001/RW.003
Kel. Ubo-ubo, Ternate Selatan
Kota Madya Ternate
MALUKU UTARA 97717
Indonesia

Job Number : 124481 **Date received :** 18/07/2012
Customer Ref : 091533 **Date reported :** 25/07/2012

Number of samples : 29

Report Comprising : Cover Sheet, Scheme Description, Results

Total Pages : 4

Notes :
N.A = Not Analyzed
I.S = Insufficient Sample
L.N.R = Listed Not Received
R.N.L = Received Not Listed

Customer Notes :
* We have identified erratic gold result for sample 5-3-1.
We have checked scree sizing and confirmed >95% pass.
* These analyses are not shipment precision

Approved Signature for:

Stephen Southern
Country Director

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Indonesia

Job Number :	124608	**Date received :**	31/07/2012
Customer Ref :	091565	**Date reported :**	08/08/2012

Number of samples : 25

Report Comprising : Cover Sheet, Scheme Description, Results

Total Pages : 6

Notes :
N.A = Not Analyzed
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Customer Notes : These analyses are not shipment precision

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Indonesia

Job Number :	124889	**Date received :**	13/08/2012
Customer Ref :	091587	**Date reported :**	27/08/2012

Number of samples : 62

Report Comprising : Cover Sheet, Scheme Description, Results

Total Pages : 9

Notes :
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R.N.L = Received Not Listed

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Job Number :	125552	**Date received :**	08/10/2012
Customer Ref :	091663	**Date reported :**	16/10/2012

Number of samples : 8

Report Comprising : Cover Sheet, Scheme Description, Results

Total Pages : 4

Notes :
N.A = Not Analyzed
I.S = Insufficient Sample
L.N.R = Listed Not Received
R.N.L = Received Not Listed

Customer Notes :
Small sample received for PC.
Sample was insufficient for next assay for appropriate method.

These analyses are not shipment precision

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Indonesia

Job Number :	125545	**Date received :**	08/10/2012
Customer Ref :	091663	**Date reported :**	24/10/2012

Number of samples : 178

Report Comprising : Cover Sheet, Scheme Description, Results

Total Pages : 18

Notes :
N.A = Not Analyzed
I.S = Insufficient Sample
L.N.R = Listed Not Received
R.N.L = Received Not Listed

Customer Notes : These analyses are not shipment precision

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Job Number :	125970	**Date received :**	07/11/2012
Customer Ref :	091694	**Date reported :**	27/11/2012

Number of samples : 13

Report Comprising : Cover Sheet, Scheme Description, Results

Total Pages : 5

Notes :
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I.S = Insufficient Sample
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Job Number : 126751 **Date received :** 26/12/2012
Customer Ref : 26/12/2012 **Date reported :** 17/01/2013

Number of samples : 144

Report Comprising : Cover Sheet, Scheme Description, Results

Total Pages : 18

Notes :
N.A = Not Analyzed
I.S = Insufficient Sample
L.N.R = Listed Not Received
R.N.L = Received Not Listed

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Approved Signature for:

Andrew Riley
General Manager

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Job Number :	126750	**Date received :**	26/12/2012
Customer Ref :	26/12/2012	**Date reported :**	18/01/2013

Number of samples : 47

Report Comprising : Cover Sheet, Scheme Description, Results

Total Pages : 10

Notes :
N.A = Not Analyzed
I.S = Insufficient Sample
L.N.R = Listed Not Received
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Customer Notes :

Approved Signature for:

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General Manager

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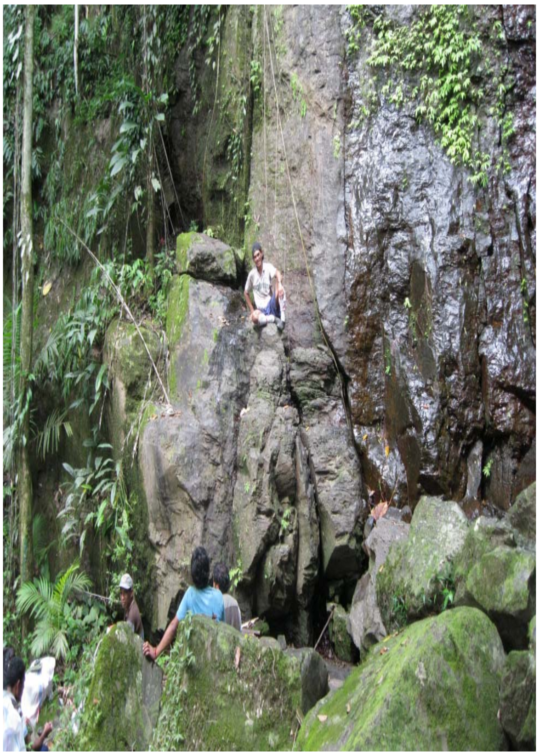
[Photo 1]

Field Survey of K&I Survey Team

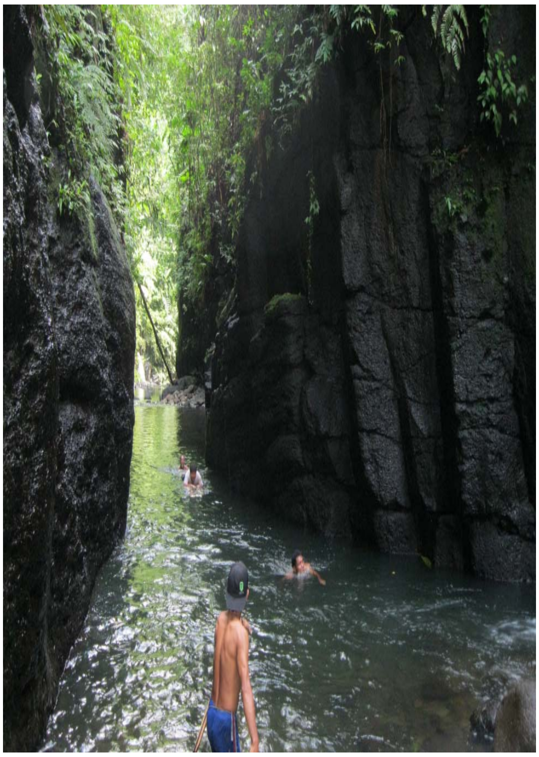
1. Roads in Goal Village

2. Approach Road to Mine Lots (Lamo River)

3. Moving for Geochemical Survey



4. Tuff near Tosoa Village (Zone 1)

	
5. Tuff at Mid Ngibut Stream (Zone 1)	6. Tuff at Upper and Mid Ngibut Stream
	
7. Unconsolidated Tuff at Ngelewar Stream (Zone 2)	8. Sampling at Upper Ngelewar Stream (Zone 2)

	
9. Quartz Vein at Sabeta Stream (Zone 2)	10. Mineralized Pyritic Quartz Vein at Sabeta Stream (Zone 2)
	
11. Quartz Vein at Waterfall of Sabeta Stream (Zone 2)	12. Gold Deposit in Sabeta Area (Zone 2)

13. Stream Sediment Sampling (Zone 2)

14. Route Map Survey in Sabeta Area (Zone 2)

15. Quartz Vein in Sabeta Area (Zone 2)

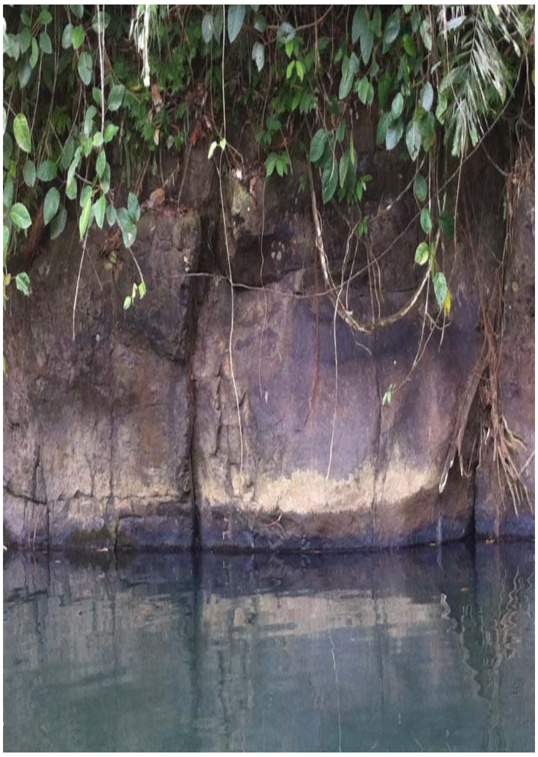
16. Ore Sampling (Zone 2)

17. Quartz Vein within Pithole in Sabeta Area (Zone 2)

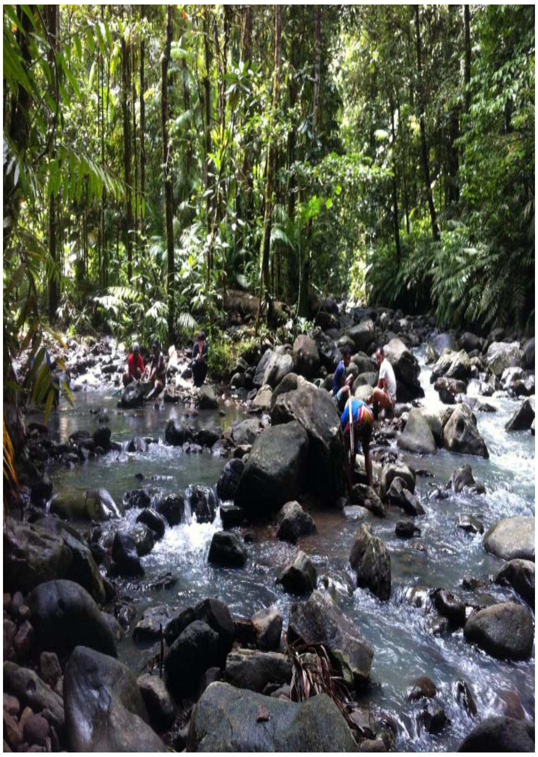
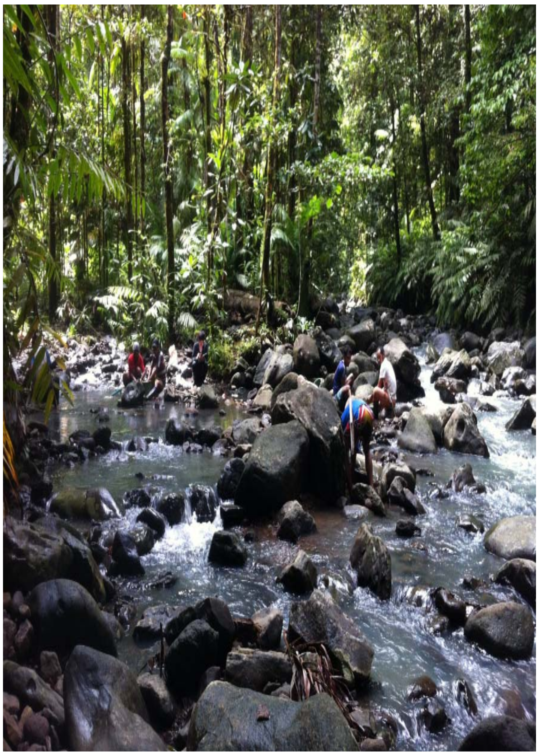
18. Fault Mineralized Zone in Sabeta Area (Zone 2)

19. Unconsolidated Stream Sediment at Ngelewar Stream (Zone 2)

20. Felsite Vein (Zone 3)

	
21. Volcanic Breccia (Zone 3)	22. Sandy Tuff (Zone 3)
	
23. Donghar Stream (Zone 3)	24. Heavy Mineral Stream Concentrate Sampling (Zone 3)

	
25. Mineralized Zone at Tarusi Stream (Zone 3)	26. Soil Sampling 1 (Zone 3)
	
27. Soil Sampling 2 (Zone 3)	28. Soil Sampling at Alteration Zone (Zone 3)

	
29. Stream Sediment Sampling (Zone 4)	30. Stream 1 (Zone 4)
	
31. Stream 2 (Zone 4)	32. Felsite Vein and Alteration Zone near Base Camp (Zone 5)

	
33. Stream Sediment Sampling (Zone 5)	34. Felsite Vein and Alteration Zone (Zone 5)
	
35. Vertical Pithole (Zone 5)	36. Felsite Vein (Zone 5)

	
37. Quartz Vein and Mineralized Zone (Zone 5)	38. Nearby Pithole (Zone 5)
	
39. Base Camp (Zone 3)	40. Porters in Survey Team

[Photo 2]

Field Survey of IRGMRSHP Team

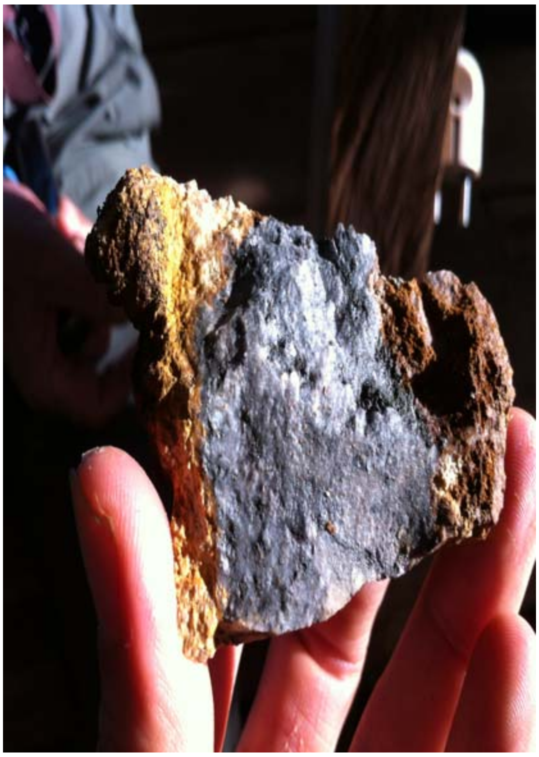
cf.) Institute of Regional Geology and Mineral Resources Survey of Hebei Province(IRGMRSHP), China

	
1. Front View of IRGMRSHP in China	2. K&I Visited IRGMRSHP in China.
	
3. K&I Visited Bright Oceans Corporations(BOCO) in China.	4. IRGMRSHP's Survey Team Arrived in Ternate Airport in Indonesia.

	
5. Briefing on Mine Geological Situation	6. IRGMRSHP's Survey Team Arrived in Ternate Port.
	
7. IRGMRSHP's Survey Team at Mine Office	8. IRGMRSHP's Survey Team at Police Station

	
9. IRGMRSHP's Survey Team at Mine Field 1	10. IRGMRSHP's Survey Team at Mine Field 2
	
11. Alluvial Gold Survey	12. Panning

	
13. Panning Result – Alluvial Gold 1	14. Panning Result – Alluvial Gold 2
	
15. IRGMRSHP's Survey Team at Mine Field 3	16. Gold Ore 1



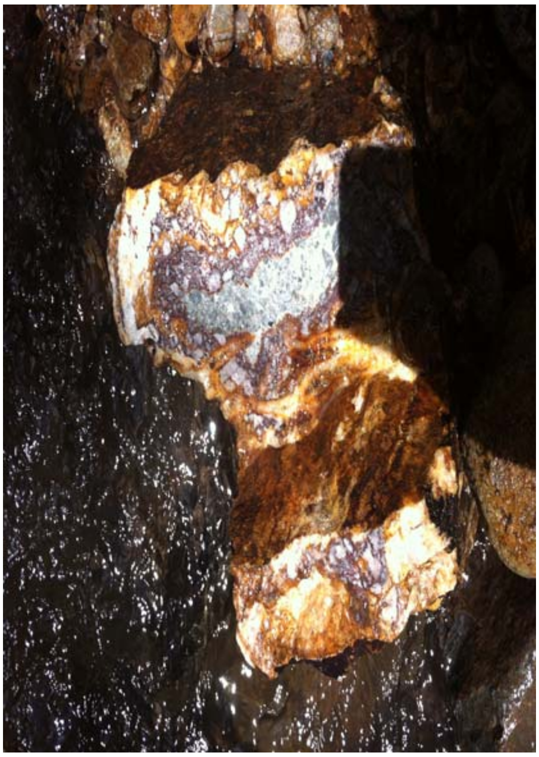
17. Gold Ore 2

18. Floating Rock Survey

19. Gold & Copper Ore

20. Tarusi Area - Outcrop of Gold & Copper Ore

	
21. Tarusi Area - Pithole	22. Gold Ore 3
	
23. Gold Ore 4	24. Gold Ore 5

	
25. Gold Ore 6	26. Sabeta Area - Pithole
	
27. Awiri Area - Pithole	28. Sabeta Area – Base Camp

	
29. IRGMRSHP's Survey Team at Mine Office	30. Arranging Samples by IRGMRSHP's Survey Team
	
31. Meeting with Head of West Halmahera County 1	32. Meeting with Head of West Halmahera County 2

33. Meeting with Head of West Halmahera County 3

34. Meeting with Head of West Halmahera County 4

35. Meeting with Head of West Halmahera County 6

36. Meeting with Head of West Halmahera County 7

37. Meeting with Head of West Halmahera County 8

38. Meeting with Head of West Halmahera County 9

39. Visited at County Office of West Halmahera 1

40. Visited at County Office of West Halmahera 2

41. Lunch with County Office Staff

42. Ternate Port

43. Cooperation Discussion btwn K&I and IRGMRSHP in China

44. Cooperation Agreement Signing btwn K&I and IRGMRSHP in China 1

45. Cooperation Agreement Signing btwn K&I and IRGMRSHP in China 2

46. Cooperation Agreement Signing btwn K&I and IRGMRSHP in China 3

47. Cooperation Agreement Signing btwn K&I and IRGMRSHP in China 4


韩国KNI公司与河北省区域地质
矿产调查研究所合作协议

按照平等、自愿、互利双赢的原则，经韩国KNI公司和河北省区域地质矿产调查研究所协商，于2013年5月13日就双方合作对印度尼西亚ORO KNI矿区进行地质勘探工作达成协议。

PT. ORO KNI　　河北省区域地质矿产调查研究所

会长 田容坤　　所长 赵永平

签字　　签字

2013年5月13日

48. Cooperation Agreement Document btwn K&I and IRGMRSHP

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