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Characteristics of Epithermal Gold Mineralization in Tanggeung Area, Cianjur West Java, Indonesia

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Abstract

The tanggeung area is situated about 50 km from Cianjur, West Java, Indonesia, or about 120 km southeast from Jakarta. Regionally the area lies the Sunda Banda magmatic arc where several hydrothermal gold-copper deposits are located. Lithology of the area is mainly composed of Late Miocene sedimentary rocks of sandstone, claystone of Bentang Formation, Pliocene hornblede andesite, overlain by Pleistocene-Pliocene pyroclastic tuff. Bentang Formation was intruded by Late Miocene hornblende andesite. The lineaments trending NW-SE and circular feature are interpreted from the combination of Landsat TM and SRTM imagery.

The hydrothermal signature is observed within the area. Hydrothermal alteration of propylitic, argilic and silicification zones are widely distributed. The propylitic zone is characterized by green color of altered sedimentary and tufaceous hostrock altered to chlorite, while argilic zone is indicated by whitish to yellowish color of tufaceous host rock that altered to clay minerals. The silicification is confined to the envelop of the quartz veins.

Several gold bearing quartz vein are observed trending almost NW-SE. The veins width range from 5 to 10 cm. The most of quartz veins are characterized by banded, colloform, comb and massive textures and contain chalcopyrite, pyrite, sphalerite and galena. Metal contenst in the quartz veins vary from 0.265 to 37.1 ppm Au; 1 to 79 ppm Ag; 32 to 40820 ppm Cu; 24 to 5370 ppm Pb; and 7 to 10580 ppm Zn.

Keywords : Epithermal, Tanggeung, Alteration, Quartz vein.

INTRODUCTION

Tanggeung area is situated about 50 km from Cianjur, West Java, Indonesia, or about 120 km southeast from Jakarta. Regionally the area lies in the Sunda Banda magmatic arc where several hydrothermal gold-copper deposits are located. There are several well known existing epithermal gold mines and gold prospect in western Java. The Cikotok and the Cirotan were two abandoned gold mines within the region, while the Cibaliung mines is still under development for underground gold mine. The active gold mine in western Java are the Cikidang and the Gunung Pongkor mines, both are operated under PT. Antam management.

The southern part of Java island physiographically is also known as Southern Mountain Zone (Bemmelen, 1949). This area is covered by volcanic products of mainly Oligocene to Pliocene age. Several gold prospects of epithermal type occur and they are still under exploration by several mining companies. Those include Papandayan gold procpect in Garut Regency, Cineam prospect in Tasikmalaya Regency, Pacitan district in East Java and high sulfidation – porphyry system in Tumpangpitu, Banyuwangi, East Java.

Figure 1. Study area

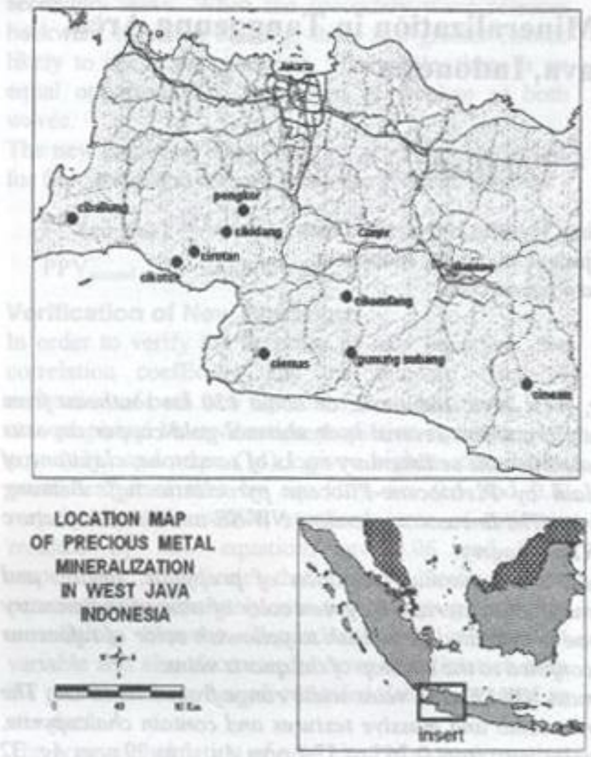

Figure 2. Gold occurrences in Indonesia

The objective of this study is to differentiate the hydrothermal mineralization in the Tanggeung area. This study will highlight the geological characteristics, alteration and mineralization the study area.

REGIONAL GEOLOGY

Tectonic Setting

The tectonic setting of western Java is much influenced by subduction of the Indian-Australian Plate under the Eurasian continent during the Cenozoic (Carlile and Mitchell, 1994), generating the magmatic arc along the back arc. The magmatic arc is associated with the hydrothermal activity generating several mineral deposit. The Sunda-Banda magmatic arc is one of the most important for hosting hydrothermal gold-copper mineralization in Indonesia.

Stratigraphic and Geological Structure

The stratigraphy of Tanggeung region is mainly composed of Middle Miocene sedimentary rocks of sandstone, claystone and conglomerate of Bentang Formation; claystone, tuff and lapili tuff of Kadupandak Member of Bentang Formation; andesitic breccia of Koleberes Formation of Late Miocene age, and is overlain by Quartenary pyroclastic tuff. The Bentang Formation was intruded by Late Miocene hornblende andesite into the Bentang Formation (Koesmono et al, 1996). The lineament trending NW-SE and circular feature are interpreted from the combination of Landsat TM and SRTM imagery.

Figure 3. Fault interpretation

METHOD

The methodology used in the study includes geological and alteration mapping, and sampling. About 162 sample were collected form the outcrop at the surface and tunnel.

60 samples were then analyzed by Xray diffractometry to identify the alteration minerals, and followed by 7 samples analyzed geochemically.

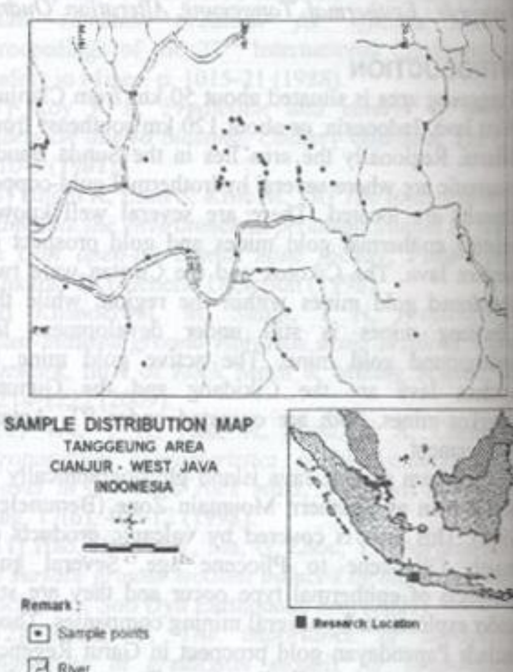

Figure 4. Sample location map

Geochemical analyses were performed at Geo-lab of the Center for Mineral Resources (PDG) in Bandung, while other laboratory analysis were conducted at the Department of Resource Engineering, Kyushu University.

RESULTS AND DISCUSSION

Geology of study area

The study area is mainly covered by sandstone and partly by mudstone of Bentang Formation of Late Miocene age. Central part of the study area is covered by tuff and lapili tuff as part of Volcanick Rock Formation of Pleistocene-Pliocene age. The volcanic breccias are locally in several area. Hornblende andesitic are locally distributed, as lava and hypabisal intrution.

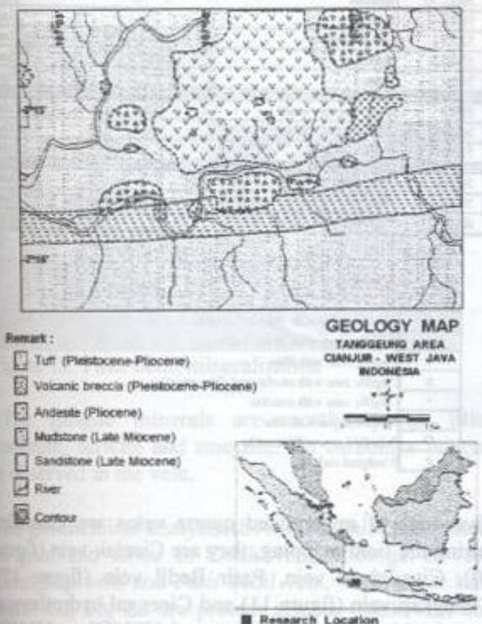

Figure 5. Geology map

The geological structure of the area is affected by the NW-SE dextral strike slip fault (Ismayanto et al, 2009).

Alteration and mineralization

The alteration zone of study area based on alteration mapping and XRD analysis can be divided into three alteration zones, they are propilitic, argillic and silisification zone.

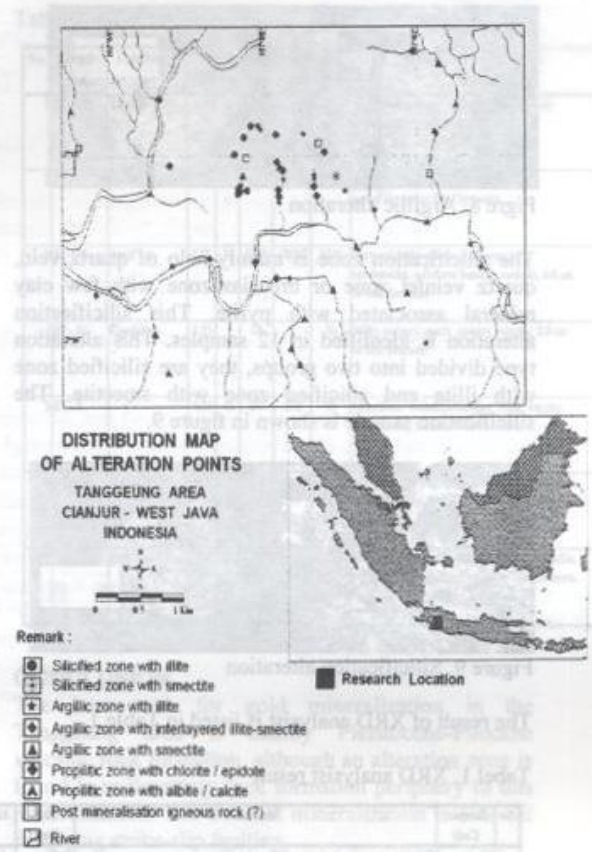

Figure 6. Distribution map of alteration points in the Tanggeung area

The propilitic alteration was identified in 16 samples in the study area. This alteration type is divided into two sub group, they are propilitic with clhorite/epidote and propilitic with albite/calcite. The sample of propilitic alteration is shown in figure 7.

Figure 7. Propylitic alteration

The argillic alteration was identified in 28 samples. Some of them are locally distributed as spotted pattern in study area. This zone is characterized by whitish to yellowish color, due to dominant clay mineral content. This alteration type is divided into three sub group, they are argillic with illite, argillic with interlayered illite-smectite and argillic with smectite. The sample of argillic alteration is shown in figure 8.

Figre 8. Argillic alteration

The silicification zone is mainly halo of quartz vein, quartz veinlet zone or breccias zone with few clay mineral associated with pyrite. This silicification alteration is identified in 12 samples. This alteration type divided into two groups, they are silicified zone with illite and silicified zone with smectite. The silicification sample is shown in figure 9.

Figure 9. Silicification alteration

The result of XRD analysist is listed in Table 1.

Tabel 1. XRD analysist result

No	Sample Code	Minerals	Host Rock	Alt
1	ST - 56	Chlorite, smectite, hematite, halloysite, illite	Tuff	φ
2	ST - 124	Chlorite, smectite, quartz, kaolinite, muscovite	Tuff	φ
3	ST - 126	Chlorite, calcite, kaolinite, quartz, smectite, muscovite, illite	Tuff	φ
4	ST - 53	Illite, smectite, albite, quartz	Tuff	#
5	ST - 58	Illite, muscovite, quartz, smectite, albite	Tuff	#
6	ST - 59	Illite, muscovite, albite, quartz	Tuff	#
7	ST - 60	Illite, albite, quartz	Tuff	#
8	ST - 66	Illite, muscovite, albite, quartz	Tuff	#
9	ST - 77	Illite, quartz	Tuff	#
10	ST - 81	Illite, muscovite, quartz, albite	Tuff	#
11	ST - 82	Illite, mucoovite, albite, quartz	Tuff	#
12	ST - 111	Illite, orthoclase, quartz, muscovite	Tuff	#
13	ST - 115	Illite, calcite, smectite, quartz	Tuff	#
14	ST - 55	Smectite, quartz	Tuff	•
15	ST - 123	Smectite, kaolinite, albite, quartz	Tuff	•
16	ST - 44 a	Quartz	Tuff	Δ
17	ST - 49	Quartz, illite, muscovite, smectite	Tuff	Δ
18	ST - 50 b	Quartz, illite, halloysite, smectite	Tuff	Δ
19	ST - 51	Quartz, illite, muscovite	Tuff	Δ
20	ST - 62	Quartz, muscovite, albite, halloysite	Tuff	Δ
21	ST - 64 b	Quartz, illite, orthoclase	Tuff	Δ
22	ST - 75	Quartz, illite, muscovite	Tuff	Δ
23	ST - 112	Quartz, illite, muscovite, smectite	Tuff	Δ
24	ST - 119 b	Quartz, hematite, muscovite	Tuff	Δ
25	ST - 133	Quartz, illite, muscovite, smectite	Tuff	Δ
26	ST - 61	Quartz, hematite	Tuff	Δ
27	ST - 71	Quartz, smectite, halloysite	Tuff	O
28	ST - 86	Epidote, albite, quartz, illite, muscovite	Volc. Bx.	φ
29	ST - 107	Chlorite, calcite, albite, smectite, quartz, illite, muscovite	Volc. Bx.	φ
30	ST - 127	Epidote, quartz, illite, smectite, muscovite	Volc. Bx.	φ
31	ST - 132	Calcite, albite, quartz, kaolinite	Volc. Bx.	θ
32	ST - 105	Illite, muscovite, calcite, albite, smectite, quartz	Volc. Bx.	#
33	ST - 41	Illite-smectite, quartz	Volc. Bx.	□
34	1.2	smectite	Volc. Bx.	•
35	ST - 15	Albite, calcite, quartz, magnetite	Andesite	θ
36	ST - 26	quartz, magnetite, albite	Andesite	≠
37	ST - 63	Albite, quartz	Andesite	≠
38	ST - 76	Albite, quartz	Andesite	≠
39	5.2	Calcite, quartz	Andesite	θ
40	ST - 8	Chlorite, quartz, albite, calcite	Sandst	[illegible]
41	ST - 35	Chlorite, calcite, smectite, quartz	Sandst	[illegible]
42	ST - 20 a	Calcite, albite, quartz	Sandst	[illegible]
43	ST - 27	Calcite, quartz	Sandst	[illegible]
44	ST - 32	Albite, quartz	Sandst	[illegible]
45	ST - 110	Calcite, quartz, albite	Sandst	[illegible]
46	3.5	Smectite, albite	Sandst	[illegible]
47	ST - 21	Illite, albite, quartz	Sandst	[illegible]
48	ST - 42	Illite, albite, quartz	Sandst	[illegible]
49	1.5	Sericite, quartz	Sandst	[illegible]
50	ST - 43	Smectite	Sandst	[illegible]
51	3.4	Smectite	Sandst	[illegible]
52	3.16	Smectite, quartz	Sandst	[illegible]
53	3.12	Smectite	Sandst	[illegible]
54	5.1	quartz	Sandst	[illegible]
55	2.3	Illite, Smectite, quartz	Mudst	[illegible]
56	2.5	Illite, Smectite, quartz	Mudst	[illegible]
57	ST - 128	Illite-smectite	Mudst	[illegible]
58	ST - 13	Illite, albite	Sed. Br.	[illegible]
59	ST - 11	Illite-smectite, calcite, pyrite, albite, quartz, smectite-kaolinite	Sed. Br.	[illegible]
60	ST - 95	Smectite, albite, dickite, quartz	Sed. Br.	[illegible]

Remark :

φ	Propilitic zone with chlorite epidote
θ	Propilitic zone with albite calcite
#	Argillic zone with illite
□	Argillic zone with interlayered illite-smectite
•	Argillic zone with smectite
Δ	Silicified zone with illite
O	Silicified zone with smectite
≠	Unaltered rock

Five zone of mineralized quartz veins are identified during the field mapping, they are Cicelak vein (figure 10), Cigadobras vein, Pasir Bedil vein (figure 12), Cilangkap vein (figure 11) and Cicengal hydrothermal breccia. Most of the vein trend N330°E to N350°E and dipping 70°-80° toward east. The veins thickness range from 2 to 10 centimeter.

The mineralized quartz veins exhibit fine-medium crystalline, vugghy, saccharoidal, colloform banding and massive texture. There is no calcite vein in the all vein zone. The mineralized quartz veins are hosted by tuff.

The ore minerals identified in the mineralized quartz vein are mainly pyrite associated with chalcopyrite, sphalerite and galena.

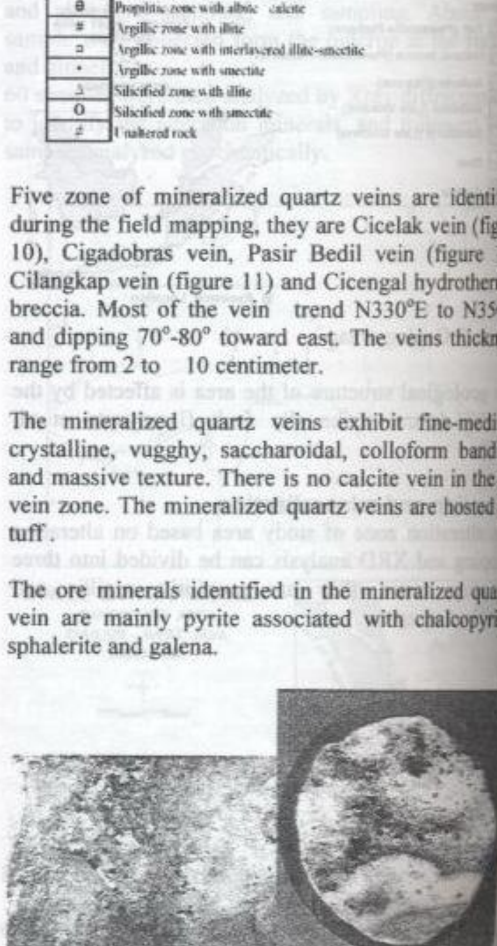

Figure 10. Celak mineralization

Figure 11. Cilangkap mineralization

Figure 12. Pasir bedil mineralization

The gangue minerals are mostly quartz, illite, kaolinite, sericite and smectite. No carbonate mineral is observed in the vein.

The geochemical analysis show the significant content of gold and silver in Celak vein, Cicengal-B vein, Cilangkap vein and Pasir bedil vein, while other base metal Cu, Pb, Zn are present also in Celak vein and Cilangkap. The distribution of mineralization is shown in figure 13and the general characteristics of quartz veins are summarized in Table 2.

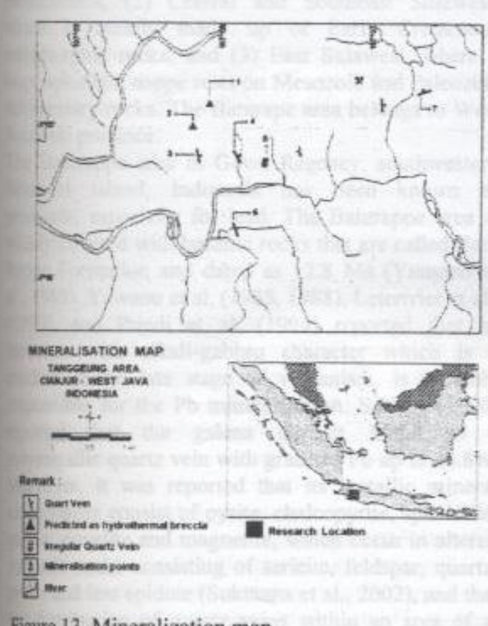

Figure 13. Mineralization map

Tabel 2. Geochemistry result and quartz texture

No.	Sample Code	Vein Name	Assay Result (ppm)					Quartz Texture / Remark
			Au	Ag	Cu	Pb	Zn	
1	ST - 61	Cicengal - B	4.4	2	46	15	79	Brecciated, crackle - jigsaw breccia, extremly silicified, no remnat of rock texture.
2	ST - 64	Cicengal - A	0.27	4	65	30	99	Brecciated rock, crackle breccia, silicified, part of the matrix filled by quartz
3	ST - 50	Celak - A	37.1	32	5370	7870	1635	Grey and milky quartz, comb, vugghy, saccharoidal, colloform banding, cockade, 6-8 cm of vein thickness.
4	ST - 44	Cigadoben	0.35	1	24	7	36	Milky and grey quartz, massive, vugghy, 2-3 cm of vein thickness
5	ST - 7		0.27	18	297	292	90	Crustiform - colloform banding, comb, vugghy, saccharoidal, 3-4 cm of vein thickness
6	ST - 14	Cilangkap	4.3	16	121	10580	40820	Milky to clear quartz, vugghy, saccharoidal, comb, 8-10 cm of vein thickness
7	ST - 13	Pasir Bedil	11.3	79	228	80	702	Milky to clear quartz, medium to coarse crystallin, vugghy, minor amethyst, 5-6 cm of vein thickness.

CONCLUSION

The host rock for gold mineralization in the Tanggeung area is mainly Pleistocene-Pliocene volcanic rock formation, although an alteration zone is found in sedimentary rock formation periphery to this mineralization. The trend of mineralization is NW-SE following strike-slip faulting.

The largest alteration zone is propylitic type which occupy almost 60% of the study area. The argillic zone lies in spotted pattern entire the study area. Whereas the silicification zone was restricted in inner part of mineralization zone on narrow halo of quartz vein.

The metal contain in each vein vary, and some of them contain high gold and base metal contents.

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