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Abstract

The site of ancient volcano of Gadjah Mungkur is situated at Selogiri area, Wonogiri, Central Java, about 40 km to the south-east from Solo city or approximately 70 km east of Yogyakarta city. Gadjah Mungkur mountain landscape, forming a circular morphology that controlled by very contrast landscape of the ridge in the southwestern and Solo River valley in the northeast. a half-circular depression on approximately 8 km in diameter is thought to be a feeder of an ancient volcanic crater or calderaa, and the intrusion complex in the center are the feeder.

The Gadjah Mungkur area and its vicinity is a part of the East Java Southern Mountain Zone, mostly occupied by both plutonic and volcanic igneous rocks, volcaniclastic, silisiclastic and carbonate rocks. Magmatism-volcanism products at Selogiri area were indicated by the abundant of igneous and volcaniclastic rocks of Mandalika and Semilir Formation and many dioritic intrusive rocks as part of the Late Eocene-Early Miocene magmatism. Porphyry Cu-Au mineralisation at Randu Kuning Prospect have strong genetic correlation with the magmatism-volcanism processes.

Many geological manifestation related with the processes of magmatism, hydrothermal and volcanism in the region Selogiri, partly still visible on the surface, and good for learning the of geological science, including of them are an outcrops of collumar joints, AA / Ropi lava, metamorphism contact rocks, and mineral ore deposits hydrotremal process as well as its texture. The sites have both a scientific worth but also a high economic value. Therefore needed a good regulation, it not only will be extracted or exploited, but some of them have to be conserved to used as next generation geological laboratories.

Key words: Ancient Volcano, Magmatis, Hydrothermal and Volcanism

1. INTRODUCTION

1.1 Background

The Randu Kuning area and its vicinity is a part of the East Java Southern Mountain Zone, mostly occupied by both plutonic and volcanic igneous rocks, volcanic clastic rocks, silisic clastic rocks as well as carbonate rocks. Magmatism and volcanism in this area is represented by the Mandalika Formation consisting mostly volcanic igneous rocks such as andesite-dacitic lavas, volcaniclastic rocks namely dacitic tuffs, and volcanic breccias. The rock unit was intruded by dioritic intrusive rocks. Volcaniclastic rocks of the Semilir Formation, as a product of the huge eruption, are exposed and scattered at the south of Selogiri area such as tuffs, lapilli tuffs, dacitic pumice breccias, tuffaceous sandstones and tuffaceous shales.

Many dioritic composition intrusive rocks were found at the Randu Kuning area, consist of pre- syn and post-mineralisation intrusive rock. However, it is difficult to distinguish this kind of dioritic intrusive in the area, due to the similar composition and texture with varying relationship to alteration-mineralisation. Imai et al. (2007) have identified three different type of intrusive rocks, namely hornblende andesite porphyry, hornblende diorite porphyry and hornblende diorite. Muthi *et al.*,(2012) recognized that

there are at least four type of diorite at the Randu Kuning area i.e. coarse grain diorite, medium diorite, microdiorite and porphyrytic plagioclase diorite.

Mineralisation type of Randu Kuning prospect was interpreted as a porphyry Cu-Au ore deposit and a number gold-base metals epithermal deposits in its surrounding (Imai et al., 2007; Suasta and Sinugroho, 2011; Corbett, 2011, 2012 and Muthi et al., 2012). The intensive erosion process has uncovered the upper parts of the porphyry deposit, whereas several gold-base metal epithermal are preserved along adjacent ridge (Suasta and Sinugroho, 2011). Many epithermal veins were also found and crosscut into deeply porphyry veins and related potassic alteration (Suasta and Sinugroho, 2011; Corbett, 2012).

1.2 Location and Accessibility

The Randu Kuning porphyry Cu-Au prospect area, situated in Selogiri, Wonogiri, Central Java, Indonesia. This location is reachable with four or two wheel vehicle, about 40 km to the south-east from Solo city, or approximately 70 km east of Yogyakarta city (Figure 1).

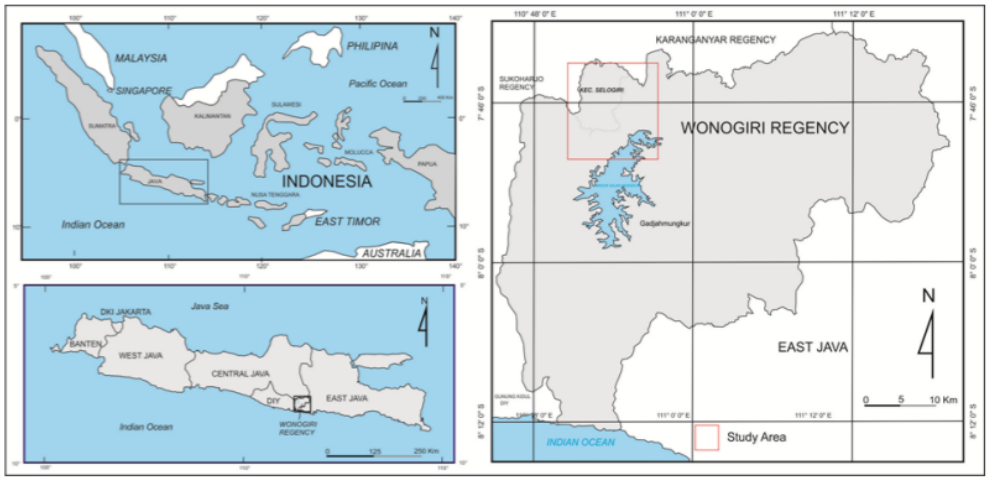

Figure 1. Location map of Selogiri area, Wonogiri

1.4 Method

This paper is a preliminary study on the hydrothermal breccia and part of the dissertation research progress. The data used in the paper are limited based on the field outcrops and drilling core observation.

2. GEOLOGY

2.1 Geology of the Southern Mountain of Wonogiri and its vicinity

Indonesia achipelagos are controled by many magmatic arcs, vary in age from Late Mesozoic through the Cenozoic. Most mineralisation are derived from five major Tertiary arcs include the Sunda-Banda, Central Kalimantan, Sulawesi-East Mindanau, Halmahera and Medial Irian Jaya (Carlile and Mitchell, 1994). Sunda-Banda arc is one of the most important six major Tertiary arcs in Indonesia extending from Sumatra through Java to east

of Damar island, known has many ore deposits (van Leeuwen, 1994; Charlile and Mitchell, 1994). The arc is the longest arc in Indonesia, developed by northwards subduction of the Indian-Australian oceanic plate beneath the southeastern margin of Eurasian continental plate, named the Sundaland (Hamilton, 1979; Katili, 1989).

The Southern Mountain stratigraphy is divided into two parts, ie. the eastern part and the western part. Stratigraphy of the eastern part, particularly Pacitan area and surrounding has been investigated by many geologists, include Sartono (1964), Nahrowi (1978), and Hanang Samudera (1992), consists of the Besole Formation that became known as Mandalika Formation and Arjosari Formation, Jaten Formation, Wuni Formation, Nampol Formation and Punung Formation.While the western part has also been widely studied by van Bemmellen (1949), Surono *et al*. (1992) and Suyoto (1992), consists of Gamping-Wungkal Formation, Kebo-Butak Formation, Semilir Formation, Nglanggran Formation, Sambibitu Formation, Oyo Formation and Wonosari Formation. The complex uncomformably overlain on the basement rocks of the Pre-Tertiary Complex consist of metamorphic rocks such as slates, schists, gneisses, serpentinites and marbles. The Middle Eocene Gamping-Wungkal Formation is characterized by calcarenites, sandstones and mudstones intercalated by tuffaceous sandstones.

Surono *et al*. (1992) interpreted that the Selogiri area is on the border between the westernpart and the eastern of the Southern Mountains, so there is a contact between the Semilir Formation and Mandalika Formation. Some rock units of the Southern Mountains Range both the western and eastern parts, were found at the Selogiri area and its vicinity will be described below, based on the 1: 100.000 Geological map of the Surakarta-Giritontro Quadrangle (Surono, *et al*.,1992) .

2.2 Geology of the Selogiri area

Morphology of the Selogiri area form hills and plains landscape with a contrast relief between each other. A contrast area of mountain range and plains landscape of the Selogiri area possibly were controlled by NW-SE and NE-SW trending major structures on approximately 8 km in diameter of a half-circular depression of an ancient volcanic crater or caldera (Imai *et al*., 2007). This argument is also supported by Hartono (2010) that the curved pattern of Gajahmungkur Mount which resembles a horseshoe shape, have volcanic fasies pattern indicating an ancient volcanic activity (paleovolcanism).

There are many type rocks found at the Selogiri area and its suround, such as volcanic breccias, andesite lavas, tuffs, and many igneous intrusive rocks such as diorites and andesites of the Miocene Mandalika and Semilir Formation, unconformably underlie Quartenary volcanic rocks of Lawu and Merapi Mt. Most of the Tertiary rocks have been strongly hydrothermal altered, caused primary rock forming minerals (feldspars, hornblendes, pyroxens), were replaced by secondary minerals (chlorites, carbonates, quartzs, hematites). These rocks lithostratigraphically could be grouped into seven rock units, *i.e*.: Tuff Unit , Andesitic Lava Unit, Pumice Breccia Unit, Calcareous Sedimentary Unit, Intrusive Rocks and Hydrothermal Breccia Unit, Volcanic Breccia of the Lawu Volcano Unit and Alluvial Deposit

Major structures at the Selogiri area, dominated by relatively the NW-SE, NE-SW, and rare N-S trendings, cross cut all of the rocks in the area, but minor E-W trending fault also was found (Suasta and Sinogrogo, 2011). The earlist and most dominant structures in the research area are the NW-SE dextral (right) lateral-slip faults, and commonly have a longer dimension rather than other trends. These structural trends then were cross cut by NE-SW and N-S sinistral (left) lateral-slip faults. The NE-SW and N-S trend mostly concentrated in the central area.

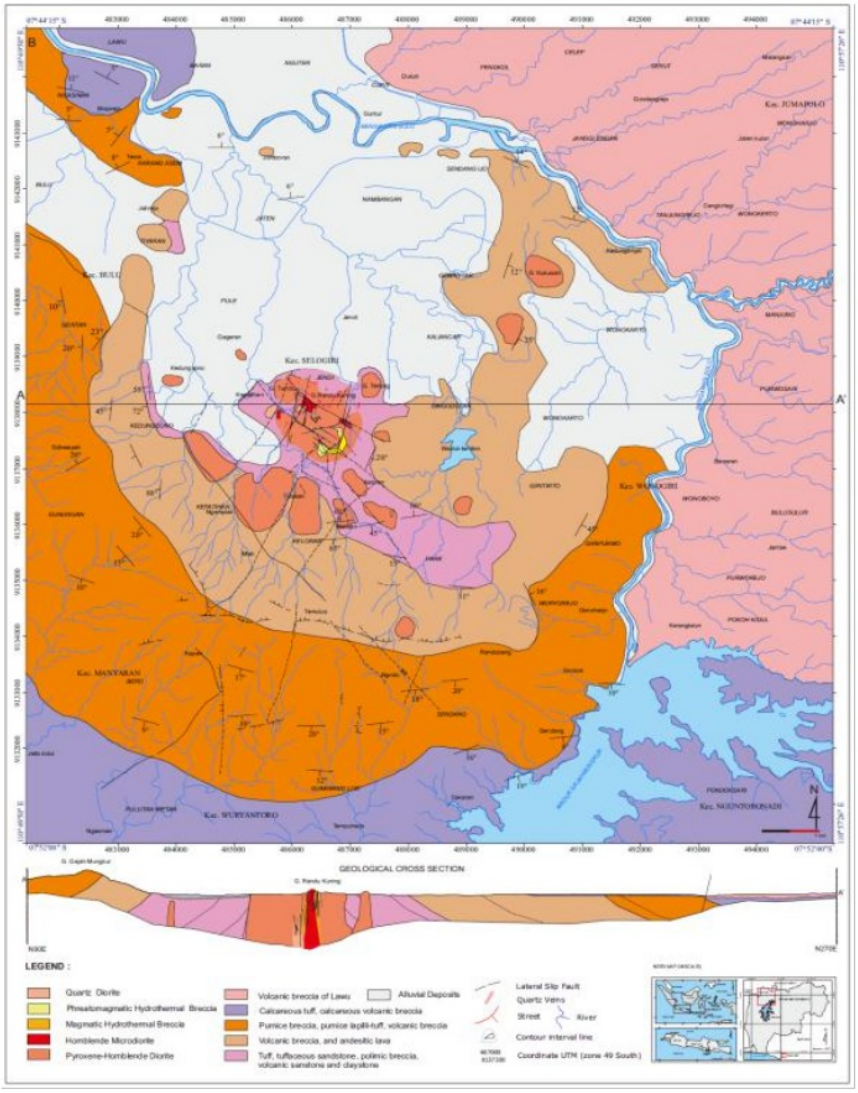

Figure 2. Geological map of Selogiri area and its vicinity (compiled and modified from Suasta and Sinugroho, 2011 and Hartono, 2010).

3. GEOLOGICAL SITES WITHIN ANCIENT VOLCANO

Many geological sites in Selogiri area have identified as a potential geological education site, such as landscape of volcano ancient crater, columnar joints, ropy lava and many altered and mineralized rocks. All of these sites were developed during magmatism, volcanism and hydrothermal processes. Most of the sites are located at the beyond of the Randu Kuning porphyry Cu-Au and intermediate sulphidation epithermal Au-base metals deposits. In case the Randu Kuning prospect then is mined, we have responsible to protect the sites above, in order can be used for educational purposes.

3.1. The Lanscape of Volcano Ancient Crater

Considering the geologic controls both lithologies and geological structures and as a fossil of an ancient volcanic crater or caldera the geomorphology of the Selogiri area then showing a beautiful landscape (Figure 3) Volcanic hills geomorphic units mostly in the southern part of the study area, are constructed by volcaniclastic rocks such as volcanic breccias, lapilli-tuffs and tuffs as well as andesitic lavas, with a height range about 230-340 m above sea level. This landscape looks like as a circular pattern, which is indicated a remnants of an ancient volcanic caldera. Alluvial plain unit stretching on the northwest part and the surrounding of the hill, mostly as an agricultural land and residentia

Figure 3. Hills of volcanic breccias in the background of rice field (top) and zoom of one of the hill above (bottom).

3.2. Collumnar Joints

Many andesitic lava at the Randubang area reveal a lot of columnar joints. Columnar joint is a hexagonal columns of joint as a result of contraction of magma during cooling. The cracks or joints are perpendicular tovthe cooling surface or the surface of the flow. Some of the andesite which shows columnar joint structures in Randubang, Selogiri, have been mined up to now. Therefore, it is needed effort to protect and conservate them.

Figure 4. Andesitic lava at Randubang area, that showing a columnar joint structures.

3.3. Ropy lava

One a andesitic lava outcrop at Bulu area, showing a ropy lava structures. The outcrop is not wide,but it gave a good information about environment of the volcano, that is a aerial volcano. Physically, ropy is lava (mostly basaltic-andesitic composition) marked with wrinkles like rope.

Figure 5. Andesitic basalt showing a ropy lava structure at the Bulu area, Seloogiri.

3.4. Magmatism, Hydrothermal and Mineralisation

Mineralisation Cu-Au-Zn in the Randu Kuning area and its vicinity is caused by the magmatism related hydrothermal alteration. The emplacement of the dioritic intrusive rocks have important role on the occurences of alteration hydrothermal and mineralisation at Randu Kuning.Many contact between dioritic intrusions and the wall rocks as well as vein zones are very importance thing in understanding of mineralisation in the area.

Figure 6 A). Contact between quartz dioritic with the intercalation of sandstone and siltstone of Kebobutak formation. Alot of carbonat-suphides veins/veinlets were found at the boundary.B).Many contact between dioritic intrusive rocks with wall rocks still remain. We can observed many kind of alteratin type, vein types as well as some ore minerals and their structure controls.

4. CONCLUSIONS

1. There are at least two type of hydrothermal breccia have recognized in the research area, i.e. magmatic-hydrothermal breccias and phreatomagmatic breccias, which were found at the Randu Kuning hill area, have taken place both in porphyry and epithermal environment.
2. Based on the texture/structure features, epithermal enviromnent phreatomagmatic breccia interpreted as eruption which have breached the surface.

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REFERENCES

Carlile, J.C. dan Mitchell, A.H.G., 1994, Magmatic Arcs and Associated Gold and Copper Mineralisation in Indonesia, Journal of Geochemical Exploration, Elsevier Science, Amsterdam, 50: 92-142.

Corbett, G., 2011, Comments on The Exploration Potential of The Wonogiri Porphyry Cu-Au Project, Central Java, Indonesia, Corbett Geological Services Pty. Ltd., Unpublished, 27 p.

Corbett, G., 2012, Further Comments on The Wonogiri Porphyry Cu-Au Project Central Java, Indonesia, Corbett Geological Services Pty. Ltd., Unpublished, 37 p.

Hartono, G., 2010, The Role of Paleovolcanism in The Tertiary Volcanic Rock Product Setting at Gajahmungkur Mt., Wonogiri, Central Java, Dissertatio in UNPAD, Unpublished, 190 p.

Imai, A., Shinomiya, J., Soe, M.T., Setijadji, L.D., Watanabe, K., and Warmada, I.W., 2007, Porphyry-Type Mineralization at Selogiri Area, Wonogiri Regency, Central Java, Indonesia, Resources Geology, vol.57, no. 2:230-240.

Isnawan, D., Sukandarrumidi and Sudarno, I., 2002, Kontrol Struktur Geologi Terhadap Jebakan Tembaga Sebagai Arahan Eksploitasi di Daerah Ngerjo dan Sekitarnya Kecamatan Tirtomoyo, Kabupaten Wonogiri Propinsi Jawa Tengah, Gama Sains IV (2) Juli 2002, p.149-157.

Katili, J. A., 1989. Evolution of the Southeast Asian arc complex, Geol. Indon. Jakarta, 12: 113-143.

Muthi, A., Basten, I.G., Suasta, I.G.M., and Litaay, N.E.W., 2012, Characteristic of Alteration and Mineralization at Randu Kuning-Wonogiri Project, Proceeding of Banda and Eastern Sunda Arcs 2012 MGEI Annual Convention, 26-27 November 2012, Malang, East Java, Indonesia, p. 117-132.

Nahrowi, T.Y., Suratman, Namida, S. and Hidayat, S., 1979. Geologi Pegunungan Selatan Jawa Timur, Bagian Eksplorasi Pusat Pengembangan Teknologi Minyak dan Gas Bumi, Cepu, 31 p.

Suasta, I.G.M and Sinugroho, I.A., 2011, Occurrence of Zoned Epithermal to Porphyry Type Cu-Au Mineralization at Wonogiri, Central Java, Proceeding of The 36th HAGI and 40th IAGI Annual Convention.

Samudera, H., 1990. Tatanan Stratigrafi dan Tektonik Pegunungan Selatan Jawa Timur, antara Pacitan dan Ponorogo, Bidang Pemetaan Geologi, Pusat Penelitian dan Pengembangan Geologi, 39 p.

Sartono, S., 1964. Stratigraphy and Sedimentation of the Eastern Most Part of Gunung Sewu (East Java), Publikasi Teknik-Seri Geologi Umum No. 1 Direktorat Geologi Bandung, 95 p.

Suprapto, 1998. Model Endapan Emas Epitermal Daerah Nglenggong, Kecamatan selogiri, Kabupaten Wonogiri, Jawa Tengah. Tesis Magister, Program Studi Rekayasa Pertambangan, Fakultas Pasca Sarjana, Institut Teknologi Bandung, 47 p.

Surono, Toha, B., and Sudarno, I., 1992, Geological map of the Surakarta-Giritontro Quadrangles, Java, Geological Research and Development Centre, Bandung.

van Leeuwen, T.M., 1994. 25 Years of Mineral Exploration and Discovery in Indonesia. In: T.M. van Leeuwen, J.W. Hedenquistt, I.P.James, and J.A.S. Dow (Editor), Indonesian Mineral Deposits-Discoveries of the Past 25 Years, Journal Geochemical Exploration, 50:13-89.

van Bemmellen, R.W, 1949, The Geology of Indonesia, and Adjacent Archipelagoes, Vol. IA, Gov. Print. Office, Martinus Nijhoff, the Hague.

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