Fluid Inclusion and Mineral Alteration of the Rorah Kadal Vein, At Cibaliung Gold Mine, Western Java, Indonesia

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Introduction

The Cibaliung gold mine is located in Western Java, Indonesia (Figure 1). The mine is operated by PT Cibaliung Sumberdaya since 2010. Gold metal reserves are over 12,800 kg and has an estimated mine life of six years. The exploration is expanding to surrounding prospect as well to get additional reserve.

Figure 1 Location of Cibaliung mine, Western Java, Indonesia

There are numerous vein systems within the Cibaliung area, such as Rorah Kadal vein with trending parallel to sub parallel of the currently mine, Cikoneng ore shoot. The Cikoneng ore shoot in the northern part was discovered in 1992, and the Cibitung shoot southern was discovered in 1997 (Prihatmoko et al., 2004). The Rorah Kadal vein is one of the veins located about 700m south of the Cibitung ore-shoot.

The Cibaliung gold deposit is reported as low sulfidation epithermal adularia-sericite type (Angeles et al., 2000) and has an age mineralization range from 11.18 to 10.65 Ma (Harijoko, et al., 2004). The epithermal deposit is well understood by mineral alteration assemblages and fluid inclusion, and it plays a key role in identifying and classifying among major parameters defining a genetic model epithermal system (Heald et al., 1987) due to the increasing exploration target.

This paper focuses on the samples from Rorah Kadal drill holes and surface outcrop, which uses for petrography observation, X-ray diffraction analysis and fluid inclusion measurement.

Geology and Mineralization

The Cibaliung area lies in the central portion of the Neogene Sunda-Banda magmatic arc that is resulted along the northern margin of the subducting Indian-Australian plate following the collision with the Eurasian plate during the Cenozoic (Carlile& Mitchell, 1994).

The Cibaliung area is a part of the Miocene Honje Igneous Complex in the western part of Java Island.The mineralization is characterized by the occurrence of gold-bearing quartz vein. The quartz vein shows colloform-crustiform texture and they are enveloped by mixed layer clay illite/smectite zone, which grades into smectite zone outward (Harijoko, et al., 207). It is hosted by the Honje Formation which comprises andesitic to basaltic lava and volcanic breccias intercalated with tuffaceous sedimentary rock and are unconformably overlain by the Cibaliung tuff (Sudana and Santosa, 1992; Angeles, et al., 2002). Harijoko et al, (2004) was reported, the Honje Formation and the Cibaliung tuff have an age of *ca* 11.4 and 4.9 Ma respectively.

Similar with the Cikoneng and Cibitung shoots, the Rorah Kadal vein system occurred along a NW-trending structure corridor in the steeply dipping vein system (Figure 2).

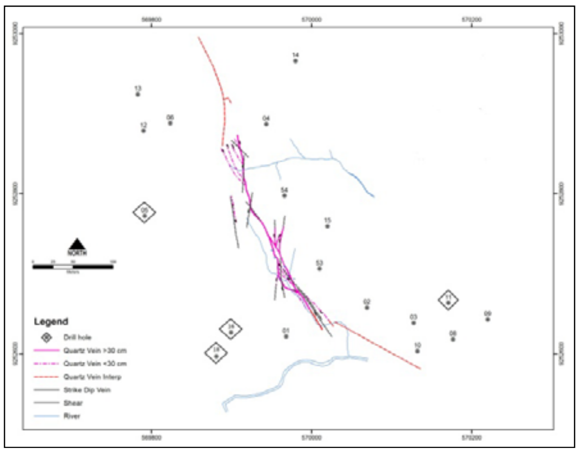

Figure 2 Vein interpretation and drill holes location for fluid inclusion (rectangular marked).

Lithology

Lithology of the Rorah Kadal host rock occupied by volcanic andesitic to basaltic lava and volcanic breccias with the main alteration minerals are clays, chlorite, pyrite and quartz (Haryanto, et al., 2012). A zone of weak to moderate silicified, and prophylitic and argillic alteration were observed of the host rock. Nevertheless, the original texture of the host rock is still visible. The pockets of vugs are occasionally observed in both of altered host rock and veins. Breccia hydrothermal with cockade texture is found in DRK03_72.85 sample, also chalcedony quartz – adularia - clay banded texture is observed in DRK03_75.10 sample.

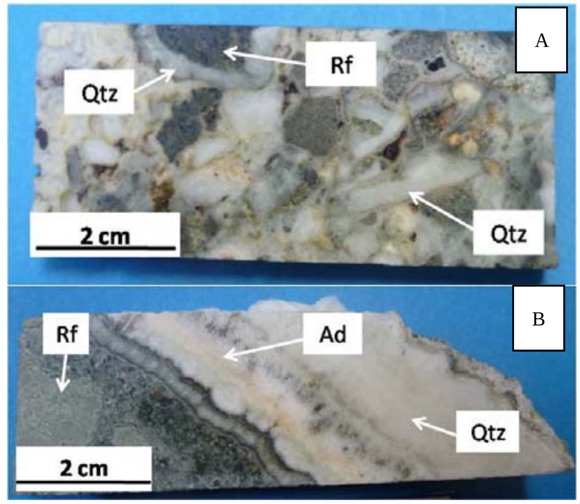

Figure 3 Breccia hydrothermal with cockade texture (A;DRK03_72.85) and banded quartz vein textures (B; DRK03_75.10 samples).

Based on the field observation, the upper portion of this prospect is covered by soil and young volcanic rock. The hydrothermal rock unit is a polymic breccia which mostly exposure in the Creek and intermittent river. The other hand, andesitic and basaltic lava are found in the drill cores. Petrographic observation shows the host rocks weak to strong altered. Volcanic breccia consists of rock fragment and quartz supported. The shape of angular to sub rounded texture embedded in the detrital volcanic matrix. The andesite lava consists of plagioclase and hornblende phenocrysts. The penetration and zonal texture are observed within weak altered prismatic plagioclase groundmass. Basalt is observed with presence of pyroxene and olivine phenocrysts.

Mineral Alteration

The altered rock most exposed along small river and creek. The argillic alteration mainly observed in the surface portion while prophylitic and silicified alteration are observed on drill holes. The X-ray diffraction analysis supported on the clay types for identification of alteration mineralogy. The mineral alteration assemblage includes illite, smectite, chlorite and epidote mostly replacing the plagioclase and pyroxene with pyrite and minor chalcopyrite disseminations. In addition, the zeolite mineral is also identified, such as laumontite. In places where the porphyry andesite and basalt intruded the breccia volcanics, the prophylitic alteration grade into argilic alteration. The clay minerals identified are mainly illite and montmorillonite (smectite). In addition, the surface outcrop exhibits pervasive silicification and argillic alteration alongside vein and veinlet outcrop. Under the microscope, the original volcanic texture is mainly replaced by silica, illite and chlorite.

The quartz vein samples show various textures such as massive, fragmented (cockade) and colloform – stratiform banding. The banding includes quartz, adularia, and clay. The fragmented texture indicates dynamic condition at that location. The selected samples exhibiting these textures are presented in Figure 3.

Fluid Inclusion

The fluid inclusion measurement was conducted on four quartz samples from drill core with double polished thin section about 100-150 µm in thickness. Freezing and heating were carried out using a Linkam stage LK 600PM. The quartz vein samples all belong to the NW trending vein associated with gold mineralization. The distribution of the samples is portrayed in Figure 2 above.

Two types of inclusion are visible at room temperature: two-phase of liquid-vapor (liquid dominant) and two-phase of liquid-vapor (vapor dominant) inclusions. The most inclusions are generally classified as liquid-rich with a liquid: vapor ratio of approximately 5:1 abundant in the samples (Figure 4A). The sizes of fluid inclusion range from 5 to 20 µm. The criteria for a primary inclusion and evidence of boiling are from Roedder (1984) and Bodnar et al.,(1985). Only primary inclusions were analyzed. The sub dendritic mechanism of trapping was observed as well (Figure 4B).

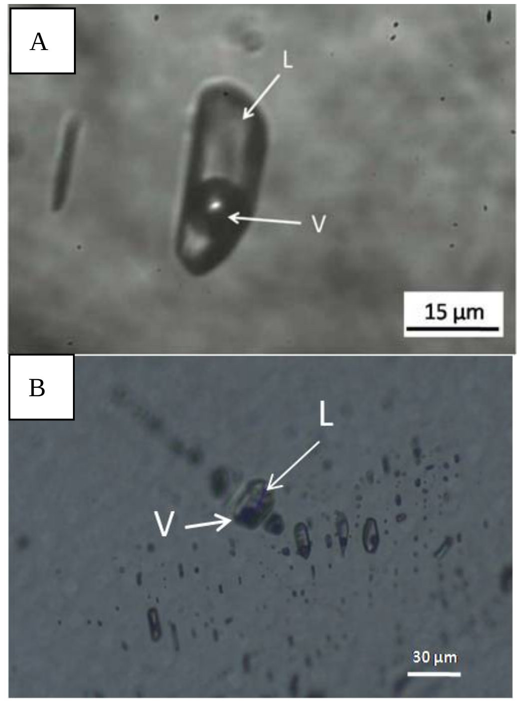

Figure 4 Photomicrograph of fluid inclusion shows liquid-rich in DRK 11_221.95 (A) and sub-dendritic growth in mechanism of trappingin DRK 05_169.45 (B) samples.

The homogenization temperature measurement of fluid inclusions in quartz from DRK 05_169.45 is ranges from 200 to 330 ^{0}C, with melting temperature of -0.2 to -0.5 ^{0}C, corresponding to salinity of 1.5 to 1.8 wt% NaCl eq.

However, the Th obtained from DRK 16_162.65 sample ranges 180-290 ^{0}C. The melting temperature of this sample exhibited relatively lower than other, it was measured of -0.5 to -1.8 ^{0}C, with corresponding to salinity of 2.0 to 4.0 wt% NaCl eq.

The DRK 18_296.70 show ranges 200-270 ^{0}C of Th, with melting temperature of -0.1 to -0.5 ^{0}C, with corresponding salinity of 1.3 to 2.0 wt% NaCl eq.

Moreover, the DRK 11_221.95 sample is exhibited a Th range of 190 to 310 ^{0}C. It has melting temperature range from -0.1 to -0.5 ^{0}C, with corresponding to salinities of 1.3 to 2.0 wt% NaCl eq.

These samples indicate the temperature slightly increased from south to the north of vein, but salinity is decrease.

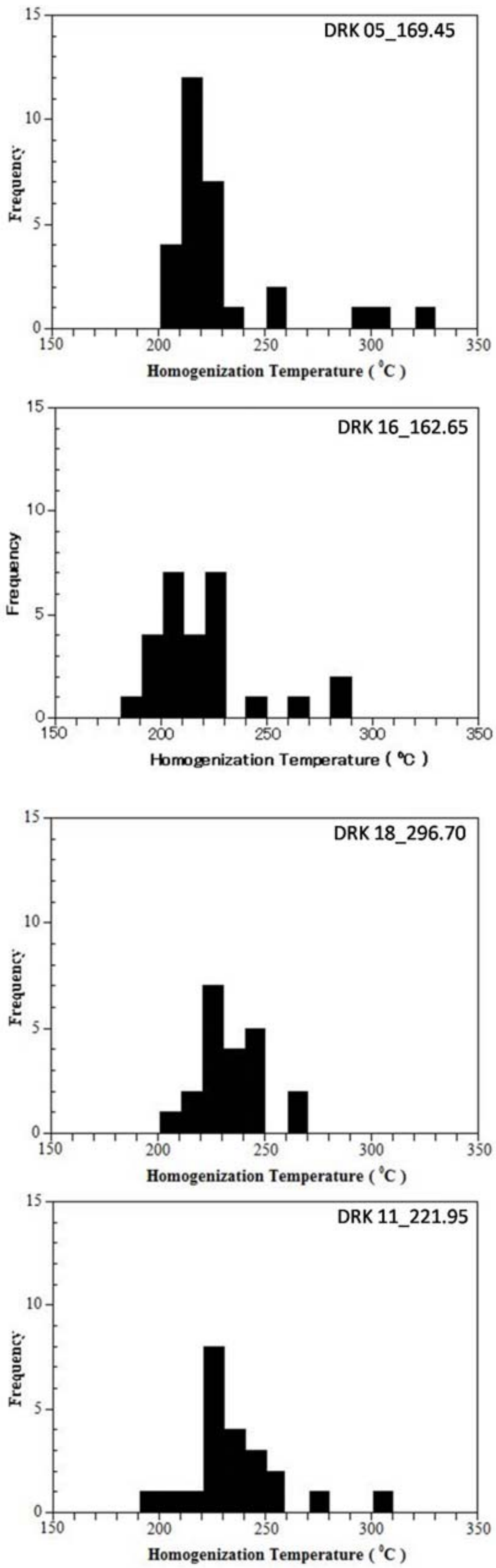

Figure 5 Temperature homogenization (T_h) from four quartz samples

Results of fluid temperature measurement in all drill cores are summarized in figure 5.

Discussion and Conclusion

The Rorah Kadal vein is occurred along dominant NW trend structure with characterized by crustiform - colloform texture that contain quartz-adularia bands. The clay mineral alteration assemblages are dominated by illite and montmorillonite (smectite) in argillic zone, while chlorite and epidote mainly exhibit in prophylitic alteration zone. Gangue minerals identified from polish section is mainly pyrite with rarely disseminated chalcopyrite.

The fluid inclusions of the Rorah Kadal vein from four drill core samples are ranging 190 to 260 ^{0}C and salinity varies from 1.5 to 4.0 wt% NaCl eq.

Based on the vein texture, mineral alteration association, and homogenization temperature and salinity of fluid inclusion obtained from quartz it conclude that the Rorah Kadal vein is belong to typical low sulfide epithermal system (Heald et al., 1987; White and Hedenquist, 1995).

Acknowledgments

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