ABSTRACT

The research area is in the southern part of Trenggalek area, East Java, Indonesia which belongs to an older arc segment of Southern Mountains Range. The purpose of this study is to describe the genetic model of epithermal gold mineralization at the Sentul and Buluroto prospects in Trenggalek area. Samples taken from ten drill cores, namely TRDD 02, 04, 05, 08, 09, 10, 18, 25, 37, and 40 were used in this study. The main lithologic units are andesite intrusion, various composition of tuff, and andesite lava and tuff breccia are also existed.

The gold-bearing quartz veins are hosted in the volcanic rocks such as tuff, andesite lava and tuff breccia which are part of Oligo-Miocene Madalika, and Arjosari Formation are characterized by massive to colloform-crustiform-banded veins. These units are composed of feldspar as main mineral and pyroxene, amphibole, quartz, chlorite, calcite, volcanic and lithic fragment. Application of tectonic discrimination plots Co versus Th diagram indicated a calc-alkaline. According to the geochemical analysis, the host rocks are derived from calc-alkali basaltic magma. Therefore, the evidence for magmatic affinity based on geochemical evidence it is still possible to conclude that all units at the southern prospects of Trenggalek belongs to the Sunda magmatic arc.

The alteration mineral patterns can be separated into two zones based on the characteristics of argillic and propylitic alteration; illite + quartz ± smectite zone and chlorite + illite ± albite zone. The observed altered mineral assemblages are chlorite, mixed layered illite-smectite, chlorite-smectite, quartz and pyrite. Illite and chlorite were detected in both shallow part and deep part of the drill cores. The

presence of illite indicates influence of relatively high temperature (<230˚C) and chlorite and illite assemblage suggest that host rocks were altered by hydrothermal fluid with neutral pH. Kaolinite and smectite are mostly observed in the near surface (the upper level of the drill hole). Because H_2S derived from magmatic water mixed with meteoric water, acidic and low to moderate temperature condition is formed near the surface. This acidic condition is responsible for forming of kaolinite. The presence of smectite may suggest relatively later hydrothermal alteration or weathering process in addition to the occurrence of halloysite.

Colloform-crustiform and comb are quartz textures in the veins most recognized in Trenggalek area. Based on the occurrence of quartz textures and dominant ore mineral assemblages, the quartz veins of Trenggalek area can be characterized; Sentul prospect consists of pyrite + chalcopyrite ± electrum ± acanthite ± galena and electrum ± acanthite ± aguilarite ± covellite bearing quartz vein with colloform-crustiform texture. Buluroto prospect consists of the pyrite + sphalerite ± chalcopyrite with mosaic texture. Quartz and calcite are noticed as gangue minerals in Trenggalek area.

Fluid inclusion microthermometry was conducted for the interest of formation temperature and salinity in quartz veins. In Sentul prospect, formation temperature of pyrite + chalcopyrite ± electrum ± acanthite ± galena and electrum ± aacanthite ± aguilarite ± covellite bearing quartz veins are 180-190 °C and 200-210°C, respectively. As decreasing in formation temperature, salinity also decreased, and this suggests that the mechanism of gold precipitation in Sentul

prospect is related with the mixing process with meteoric water. The precipitation in electrum ± acanthite ± aguilarite ± covellite of Sentul prospect is formed under boiling process. Boiling process is an important mechanism for gold precipitation since the occurrence of electrum. Similarly, in Buluroto prospect, formation temperature of pyrite ± sphalerite ± chalcopyrite bearing quartz vein is 190-200 °C.

Based on SEM-EDS analysis, silver contents in electrum of Sentul and Buluroto prospects range from 50-60 at% and 40-50 at%. In addition, FeS contents in sphalerite were estimated in pyrite + sphalerite ± chalcopyrite of Buluroto prospect with the result of 1.8-2 mol%. By a combination of formation temperatures and SEM-EDS results, sulfur fugacity of each vein can be constrained and suggested that sulfur fugacity of all quartz vein in both prospects, Trenggalek area can be classified as intermediate sulfidation state. Genetic model of the study area consists of seven main stages based on the formation development, ore forming condition and hydrothermal thermal alteration and mineralization processes. The stages are; (i) at 33.6 Ma, deposition of Mandalika Formation under the sea water, (ii) development of limestone with indication of lepidocyclina sp. foraminifera accumulated in shallow warm marine environment at the Middle Miocene (iii) complex of intrusion-volcanic at 17.1±0.8 Ma (iv) alteration/mineralization are formed at 16.29 ± 0.56 Ma (v) overlapping of mineralization and younger formation and depositional break down and/or pause of eruption after 15.6 ± 0.5 Ma (vi) andesite lava flow and younger unit tuff breccia on the surface by the pyroclastic explosive eruption (vii) after exogenic process, current surface at shallow part appeared with mineralized quartz veins are source of intermediate-sulphidation

epithermal gold deposit. Studying on genetic model of epithermal gold deposits at the southern prospects provides the basis for the selection of favourable areas for regional to prospect-scale exploration.

Key words: *Geology, Hydrothermal alteration and mineralization, Hydrothermal fluid, Quartz vein, epithermal, gold deposit, Trenggalek, Genetic model*