ORE GENESIS OF THE EE3 GOLD PROSPECT IN THE THONE MYAE SONG AREA, BANMAUK DISTRICT, NORTHERN MYANMAR

テッ, サンダー, アウン

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氏　　名　：　テッ　サンダー　アウン

論文題名　：　ORE GENESIS OF THE EE3 GOLD PROSPECT IN THE THONE MYAE SONG AREA, BANMAUK DISTRICT, NORTHERN MYANMAR (ミャンマー北部 BANMAUK 地方 THONE MYAE SONG 地域の EE3 鉱区における金鉱床の成因)

区　　分　：　甲

論　文　内　容　の　要　旨

Several gold deposits are found in the Central Magmatic-Volcanic Belt (CMVB) of Myanmar, which forms a nearly N-S trending, 1500 km long arc extending from the Andaman Sea to northern Myanmar. The arc consists of Cretaceous granitoids intruded into folded andesites and pillow basalts (the Mawgyi Andesite) which rest on cherts, talc-schists, mudstones and phyllites. The EE3 prospect is part of the Thone Myae Song deposit, located in the Kawlin-Wuntho Block in the northern part of the CMVB. In this area, there have been many small-scale local gold mines since 1980, not only primary but also alluvial gold mines. There are three gold prospects in the Thone Myae Song area such as the EE3 prospect, the Myauk Let Sho prospect, and the Thapan Aing prospect. The gold mineralization is hosted by Mawgyi Andesite. This dissertation describes the characteristics of the gold mineralization of the EE3 prospect based on field observation, ore mineralogy, fluid inclusion and sulfur isotope study. The main purpose of this study is to constrain the condition of gold mineralization in the EE3 prospect. This dissertation consists of the following seven chapters.

Chapter 1 introduces the location of the research area, previous works of the surrounding area, problem statements, thesis aims and objectives, research methodology, field work and sample collection, laboratory works, and expected outcome.

Chapter 2 reviews the geological background and tectonic setting of the study area including tectonic belts related with most important gold deposits surrounding the study area, including Kawt-a-Bum-Mt Loimye Segment, Wuntho-Banmauk Segment, Monywa-Salingyi Segment and Mount Popa Segment in the Wuntho-Popa Arc. The Thone Myae Song deposit is located in the Wuntho-Banmauk Segment in the Wuntho-Popa Arc.

Chapter 3 presents the regional geology, and deposit geology which describes field observation, megascopic, and microscopic study of the Mawgyi Andesite, mudstone and phyllite (Shwedaung Formation), shale and sandstone (Wabo Formation). Lower Cretaceous Mawgyi Andesite is the most widespread and most distinctive volcanic rock of the study area. Upper Triassic mudstone and phyllite are overlain by Mawgyi Andesite.

Chapter 4 demonstrates the hydrothermal alteration related to gold mineralization at the EE3 prospect. Hydrothermal alteration along the quartz veins in the area encompasses proximal (sericite-calcite alteration), intermediate (epidote-calcite±albite alteration) and distal (chlorite-calcite alteration) alteration zones that are defined by mineral assemblages. The strongly altered rocks adjacent to auriferous quartz veins are typically enriched in sulfide minerals. Further away from the vein, the alteration is characterized by various amounts of chlorite and calcite, but the proximal parts of the vein comprise epidote, quartz, chlorite, sericite and carbonate minerals.

Chapter 5 discusses the mineralization style of the EE3 prospect and paragenesis of the deposit. The ore body forms as massive sulfide quartz veins. Based on the mineral assemblages and cross-cutting relationships, three mineralization stages are defined: (1) N-S trending quartz-calcite-sulfide main veins (V1) (Stage I), (2) E-W trending quartz-calcite vein (V2) that intersected the main veins (Stage II), (3) the third generation quartz-calcite veins (V3) parallel to the main veins (Stage III). Stage I is the earliest sulfide-forming stage. Stage I veins contain pyrite, chalcopyrite, sphalerite, magnetite and native gold. Stage II veins contain pyrite with very rare chalcopyrite. The Stage II is not accompanied by significant gold mineralization. Calcite commonly occurred in this stage. Stage III veins contain pyrite, chalcopyrite, magnetite, native gold, tellurobismuthite, calaverite and petzite. Tellurobismuthite often coexists with chalcopyrite and pyrite.

Chapter 6 delivers the study on fluid inclusions of the EE3 prospect. This study on the EE3 prospect recognizes three types of fluid inclusions in the Stage I mineralized quartz veins: Type-A: two-phase, liquid-dominated, liquid (L)+vapor(V) inclusions. Type-B: two-phase, vapor-dominated, vapor (>60 vol%) + liquid inclusions. Type-C: three-phase, (liquid H_2O + carbonic liquid + carbonic vapor) inclusions. On the other hand, in the Stage II veins and Stage III veins, Type-A and Type-B fluid inclusions are found. The homogenization temperatures of Type-A fluid inclusions of Stage I veins range from 180 to 360 °C (mode at 310 °C), with salinities ranging from 0.3 to 9.2 wt. % NaCl equivalent. The homogenization temperatures of the Type-B fluid inclusions range from 315 to 430 °C (mode at 350 °C) with salinities varying from 0.5 to 6.4 wt. % NaCl equivalent. The homogenization temperatures of Type-C inclusions vary from 220 to 356 °C (mode at 310°C), with corresponding salinities range from 1.2 to 7.4 wt. % NaCl equivalent. Type-A fluid inclusions in Stage II veins yielded homogenization temperatures ranging from 176 to 387 °C (mode at 310 °C), with corresponding salinities range from 1.7 to 8.8 wt. % NaCl equivalent. The homogenization temperatures of the Type-B fluid inclusions range from 287 to 436 °C (mode at 410 °C) with salinities ranging from 3.5 to 11.1 wt. % NaCl equivalent. The homogenization temperatures of Type-A fluid inclusions in Stage III veins range from 158 to 340 °C (mode at 210°C), with corresponding salinities range from 0.5 to 10.6 wt. % NaCl equivalent, while the homogenization temperatures of the Type-B fluid inclusions range from 278 to 464 °C (mode at 350 °C) with salinities ranging from 0.9 to 7.5 wt. % NaCl equivalent. Based on the coexistence of Type-A fluid inclusions and Type-B fluid inclusions, the formation temperature and pressure conditions were estimated from the fluid inclusions assuming boiling conditions, at 180 °C and 28 bars for Stage I, 176 °C and 26 bars for Stage II and 158 °C and 21 bars for Stage III, which correspond to formation depths of about 300 m, 260 m and 215 m, respectively. Therefore, the condition of mineralization at the EE3 prospect corresponds to an epithermal system. The $\delta^{34}S$ values of the sulfides narrowly range from +0.5 ‰ to -3.0 ‰, indicating that sulfur was most likely derived from the volcanic rocks that host the mineralization or a magmatic source at depth.

Chapter 7 presents conclusions of this thesis by general conclusions and recommendations for further research on this area.