GEOLOGY AND GOLD MINERALIZATION AT THE SHWEGYAUNG – MANKAT AREA, SOUTHWESTERN PART OF BANMAUK TOWNSHIP, SAGAING REGION, UPPER MYANMAR

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Abstract

The Shwegyaung-Mankat area is situated within Banmauk Township, Katha District, Sagaing Region. It is involved Wuntho Massif Uplift bordered on the west by Chindwin Basin and on the east by Sagaing Fault. The geology of this area is predominantly occupied by Hpyu Taung Metamorphics, Shwedaung Formation, Mawgyi Andesite, Mawlin Formation, Kanza Chaung Batholith Group, and Wabo Formation. Gold mineralization associated with volcanoclastic rocks of Lower Cretaceous, mineralized quartz veins in fracture zone of Hpyu Taung Metamorphics, and intrusive rocks of Kanza Chaung Batholith Group. Gold-bearing quartz veins from the research area are characterized by sheeted veins, massive, veinlets and fracture-filling textures. Base on geological setting, structure control, alteration minerals, hosted rock and mineralization style, the research area is expected to be epithermal related low-sulfidation gold mineralization. Mineralized quartz veins hosted in Mesozoic age of volcanic, metamorphic, and intrusive rocks. Evidence of mineralized veins structure and ore texture, the mineralization style of research area is considered to be low-sulfidation epithermal deposit. The age of mineralization is probably post Paleozoic time.

Keywords: Mawgyi Andesite, Hpyu Taung Metamorphics, Kanza Chaung Batholith, Epithermal, Low-sulfidation, Gold mineralization

Introduction

Location, Size and Accessibility

Shwegyaung-Mankat area is situated within Banmauk Township, Katha District, Sagaing Region in northern Myanmar. It lies about 4 km southwestern part of Banmauk Town and falls in topographic maps index no. 83-P/15 and 83-P/16 on a scale 1 inch to 1 mile (1 : 63360). It is bounded by Latitude 24º 11′ 29" to 24º 24′ 33" N, and Longitude 95º 46′ 33" to 95º 54′ 29" E. The area covers approximately 264 square kilometers in extent.

In this area can be reached directly using Mandalay-Myitkyina motor road and railway line, transit of Indaw to Banmauk Townships (Fig-1).

Materials and Methods

The research work was conducted using the following instruments; One inch topographic map references, Aerial photographs, Landsat TM images, Brunton compass, Geological hammer, G.P.S, Stereoscope, Tape, Digital camera and Computer.

Tape and Compass Traverse method was applied in the field. The data measured was plotted in the field on base map sheet. Representative samples were collected by using the G.P.S and Geological hammer. Recording detail locations and lithology in the field notes and taking the photos. Slope and other geological structures were measured by Brunton compass.

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Regional Geology

Regional geologic setting

Regionally, the present research area is covered with the Mesozoic and Cenozoic rock units ranging from Pre-Upper Triassic to Post-Oligocene in age. In this area, the Mesozoic and Cenozoic rock units are extensively exposed (Fig-2).

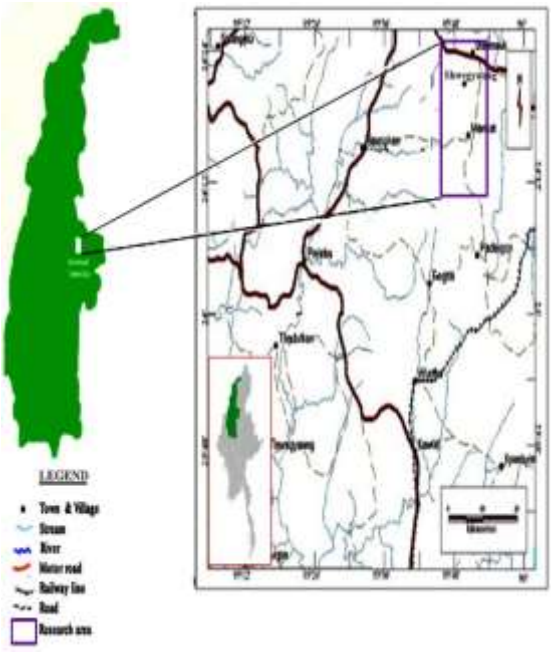

Figure: (1) Location and accessibility map of research area

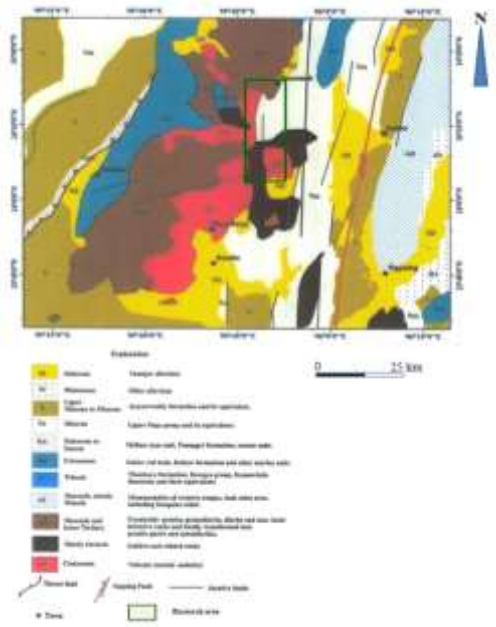

Figure: (2) Regional geological map of research area (MGS, 2014)

Area Geology

During the field works, (114) samples of rock and ore were collected from the research area for various observations and analysis in laboratory, (48) samples of rock and (66) samples of ore were collected for petrographic study as well as geochemical analysis, (34) mineral samples from mineralized quartz veins, and (16) samples of altered wallrock were collected for petrographic study. There are (22) samples of rock from the shear zones of andesite, dacite, diorite and granodiorite were also collected for petrographic study.

Stratigraphy

Stratigraphically, the research area consists of rock units ranging from Pre-Upper Triassic to Quaternary in age. Investigated area is mainly composed of the succession of seven stratigraphic rock units. This seven stratigraphic rock units from oldest to youngest are described in table (1).

The research area is mainly composed of volcanic rock unit, andesite, locally called Mawgyi Andesite (Lower Cretaceous), plutonic rock unit of Diorite in Kanza Chaung Batholith Group (Upper Cretaceous) and sedimentary rock unit of Wabo Formation (Oligocene to Miocene).

Distribution of major rock units

Regionally, the Mesozoic and Cenozoic rocks are exposed in present research area (Fig-3).

Table (1): Stratigraphic succession of rock sequences exposed on the research area (After UNDP, 1979)

Rock Sequence	Age
Alluvium	Quaternary
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Wabo Formation	Oligocene to Miocene
^^^^^^^^^^^^^^^^^^^^	
Kanza Chaung Batholith Group	Upper Cretaceous
Mawlin Formation	Lower Cretaceous
Mawgyi Andesite	Lower Cretaceous
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Shwedaung Formation	Upper Triassic
Hpyu Taung Metamorphics	Pre-Upper Triassic

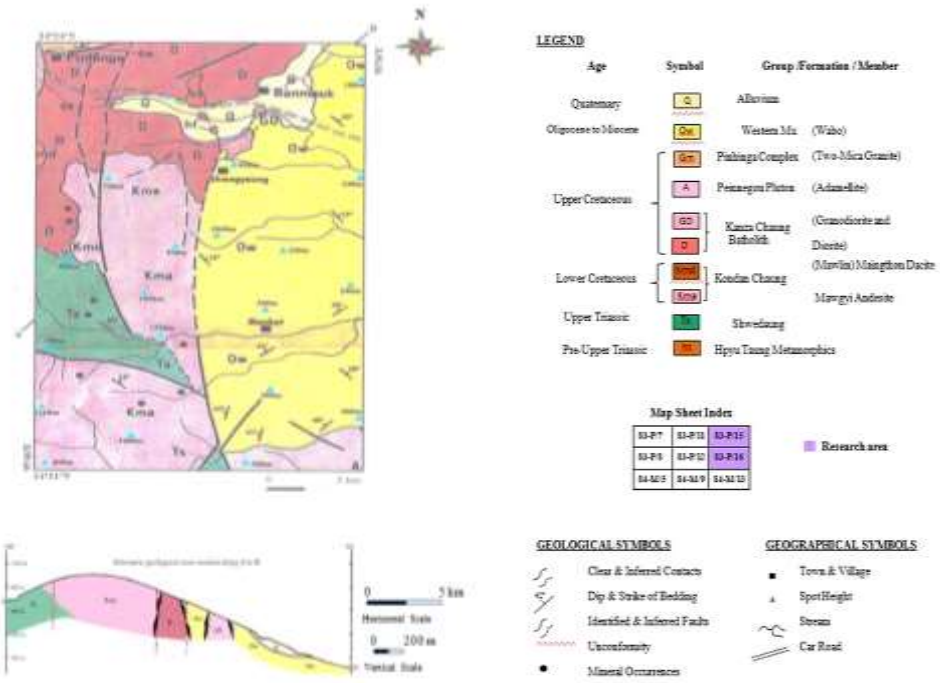


Figure: (3) Geological map and cross-section of research area (Lwin Ko Zin Win, 2023)

Geological structure

The research area lies between Wuntho Massif at the west and still active Sagaing Fault at the east. So, the geological structures of this area is very complex. Mainly, attitude of beds, fold, fault, foliation, joint and unconformity can be found as the geological structures.

Fold

There are no major anticlinal and synclinal folds in the research area. However, small scale minor contoured folds and drag fold in the schist (Fig-4).

Fault

Nankan-Banmauk valley is a fault trough controlled by two major faults as Taungchaung Fault on the east, and Chutkon-Legyin Fault on the west. Gold deposits are related by fault system. Mineralizations of Banmauk area generally occur as N-S, NNW-SSE and E-W trend (Fig-5).

Figure: (4) Minor contoured fold in the quartz schist

Figure: (6) Base-metals mineralizaiton in Kanza Chaung Batholith Group

Mineralization

Host lithology

Gold mineralization is confined with the andesite, schist and diorite rocks, and veins are mostly of fissure-fillings type. The mineralization trend NNW to SSE direction, and the dips are almost vertical. This veins thickness are varies from 10 to 350 mm. Gold ore deposits in research area are hosted in the Kanza Chaung Batholith (Wuntho Massif). The mineralized gold veins are predominantly occur hosted in andesite and diorite body. In many places, the veins are follow fracture-filling textures. Some mineralized quartz viens are recognized in the fracture zone of metamorphic rocks and diorite body. Auriferous quartz veins are found as the fracture-filling textures in diorite body. In research area, the quartz gold veins are injected into the andesite and diorite bodies as hydrothermal breccia and fracture-filling form. Generally, gold and base-metals mineralizaiton are mainly found in andesite and diorite occur along the faulted contact zone and dipping of fault is N 70º E (Fig-6).

Gold mineralization in Wuntho district

The gold mineralization in Wuntho district is largely confined to the Banmauk-Wuntho inlier. Here, it is found principally as Au-bearing quartz veins (or) Quartz-carbonate veins, which are exploited in small scale mines at gold grades of 20 to 100 g/ton Au (Mitchell et al., 1999), and lie within the Upper Cretaceous granodiorite locally extending into the schist and volcanic country rocks (United Nations, 1978 and Khin Zaw, 1990). Similar gold veins are also found father north in the Mabein district within Tagaung-Myitkyina Belt, and here Mitchell et al.

(1999) make reference to the epithermal Au-bearing veins are found within strongly silicified host rocks of Upper Oligocene to Lower Miocene mudsone and sandstone. Low-sulfidation epithermal gold quartz veins are also reported from the south of Shangalon (Ohn Thwin, 2004).

Gold mineralization in Shwegyaung-Mankat area

The research area have five prospects. In these prospects are mainly used underground mining method (adit, inclined and vertical shaft). They are Kanbat (KB) and Legyin (LG) adits, Thahtaymaw (THM) and Nansamsar (NSS) inclined, and Shwekyin (SK) shafts. The total depth of KB-1 adit is approximately 760 m and KB-2 adit is about 160 m from mine portal which locates 680 and 720 m above from the sea level. The main adit is 225º trend. In these adits, gold-bearing quartz vein generally N-S and NE-SW dipping. Gold-bearing quartz vein is hosted in andesite. The total depth of THM inclined is approximately 850 m and NSS-2 inclined is about 140 m from the mine portal which locates 430 and 350 m above from sea level, which inclined to 305° trend. In these inclined, gold-bearing quartz is hosted in the contact between mudstone and andesite can be observed at 25 m. Gold-bearing quartz vein is hosted in andesite. The total depth of SK-1 and 2 shafts are approximately 500 m from the mine portal which locates 770 m above from sea level. This prospect has four levels, in each level spacing nearly 130 m from the mine portal. In this prospect, gold mineralization is mainly hosted by andesite. The gold-bearing quartz veins trend nearly N-S with steep dipping 50º to 60º and thickness is about 0.1 to 1.5 m (Fig-7).

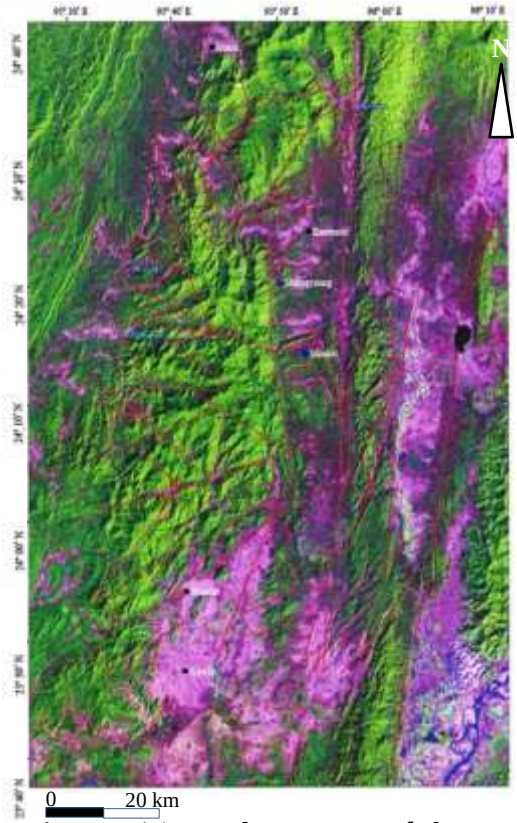
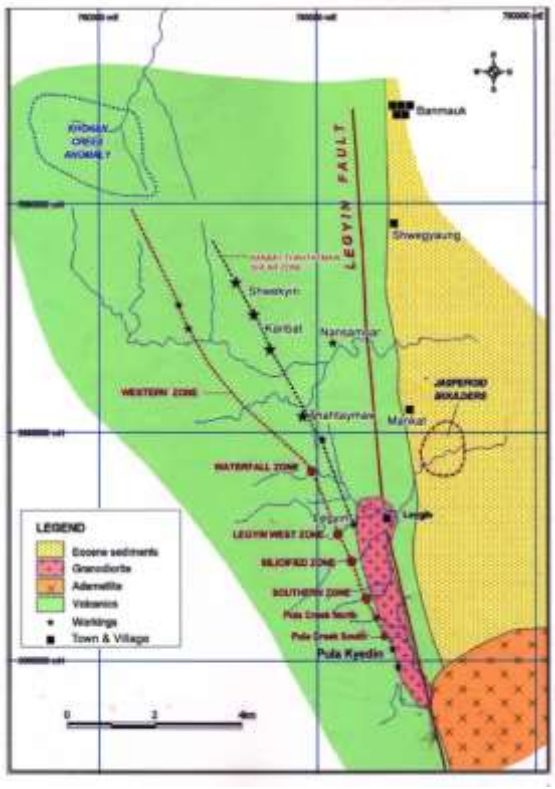


Figure: (5) Landsat image of the research showing area and its environ



Figgure: (7) Plan view map of research area geology and main prospects (Lwin KoZin Win, 2023)

Gold mineralization of the research area is characterized by sheeted vein, stockwork, massive and small veinlets. Mostly, mineralized veins are occurred along the fault and breccia zones. The vein trends have two directions: nearly N-S direction, and NNW-SSE direction. According to the field observation, the mineralization gold-bearing quartz veins are massive,

sheeted, veinlets and fracture-filling types. The thickness of vein is 0.1 to 0.5 m (Fig- 8 a, b, c, d), (Fig- 9 a, b, c, d, e, f) and (Fig- 10 a, b, c, d).

There are two mineralization zones of gold-bearing massive quartz vein occur in this research area. They are - (1) Massive quartz veins occur in Kanbat adit. It is trending NW-SE, and its dipping ranges from 38º to 65º. The thickness of vein is 0.12 to 0.3 m, and (2) Stockwork form and quartz veinlets are occur in Shwekyin worksite. It is nearly N-S trending, and its dipping ranges from 55º to 59º. The thickness of vein is 0.15 m (Fig- 11 and 12).


Figure: (8 a and b) Massive quartz vein underground adit in Kanbat mine (1)


Figure: (8 c and d) Shear plane and breccia zone of underground adit in Nansamsar mine (2)



Figure: (9 a, b, c and d) Massive and laminated quartz vein in gold-bearing quartz vein of underground adit in Thahtaymaw mine


Figure: (9 e and f) Small quartz veins are inclining various angle


Figure: (10 a and b) Massive and laminated quartz vein in Shwekyin prospet (1)


Figure: (10 c and d) Gold-bearing quartz vein of underground adit in Shwekyin prospet (2)

Figure: (11) Massive quartz vein occur in Kanbat range

Figure: (12) Massive form and quartz veinlets occur in Shwekyin

Ore Samples were collected from many worksites of the research area, which is vertical pit (or) shaft, inclined and aditing by the timbering supported. In this research area, gold mineralization occurs in two settings. They are - (1) Massive vein type gold-bearing quartz vein hosted in andesite, and (2) Stockwork type gold-bearing quartz located in diorite shows the nature of mineralized quartz veins occur in research area (Fig- 13 a, b, c and d).

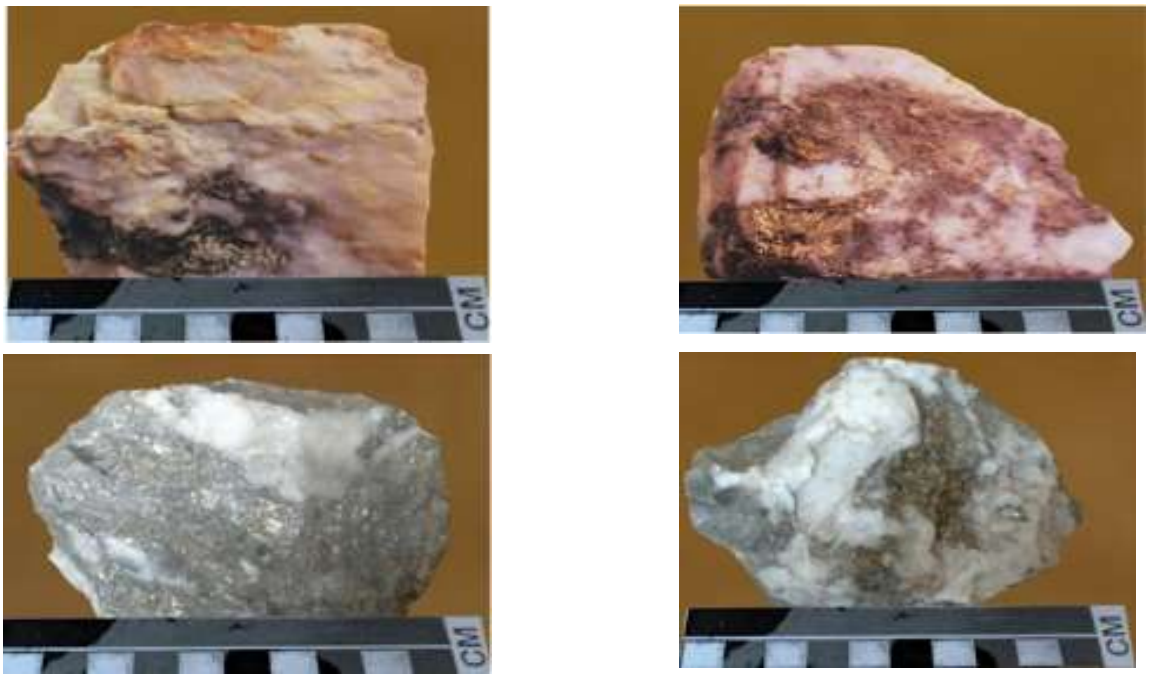


Figure: (13 a, b, c and d) Nature of gold mineralized quartz veins in research area

Figure: (14 a, b, c and d) Nature of gold-bearing quartz veins occur in andesite

The field study and microscopic examination of research area show that the rocks are moderate to intensely alter. In some samples, the alteration is highly intense that primary textures have been destroyed and the original lithology cannot be determined. Strongly altered rocks are adjacent to auriferous quartz veins are typically enriched in the sulfide minerals. The hypogene sulfide minerals are pyrite and chalcopyrite. It is possible sources of mineralization associated with the hydrothermal fluids in this area (Fig- 14 a, b, c and d).

Results and Discussions

Lithologic control

The mineralization zone occurs in volcanic rock of the andesite, metamorphic rock of the schist, and plutonic rock of the diorite. These rocks are often occur strongly altered near the fault zone, and gold-bearing quartz vein occur as the stockwork, sheeted, massive and small veinlets. The intrusive bodies may be carried up the heat source of hydrothermal fluids along the fracture. The quartz vein is giving a variable thickness, from as little as 0.05 m and as much as 0.3 m. Immediately, near surrounding the quartz vein, host rock is strongly altered with localized the chlorite development. Brecciation and fracturing of the host rocks are ground preparation for quartz vein associated with the gold deposition.

Structure control

The research area is situated between Sagaing Fault to the east and Wuntho Uplift to the west, the various deformations and magmatism has subjected to the rocks. There are two mineralization zones of gold-bearing massive quartz veins occur in research area. Mineralized zone lies within along the major fault zone, and gold content is rich in the shear zone between quartz veins and host rocks. It is suggested that time of mineralization approached to the development of intrusion related and this area can be more favorable to development the fracture zone.

Possible age of mineralization

This research area is located between Sagaing Fault to the east, and Wuntho Uplift to the west. The possible age of mineralization is mainly noticed the two points. They are- lithologic and structural controls. The mineralized quartz veins are mainly hosted in Mesozoic age of volcanic rock (Lower Cretaceous andesite), metamorphic rock (Pre-Upper Triassic schist), and intrusive rock (Upper Cretaceous diorite). They are considered to be found together as the hydrothermal process. According to the veins type, ore texture, major fault trending system, age of mineralized host rocks, and style of mineralization is probably later than the hosted rocks.

Therefore, the age of mineralization in Shwegyaung-Mankat area is probably post Paleozoic time.

Type of mineralization

The type of mineralization of research area is based on the geological setting, structure control, alteration minerals assemblage, hosted rock and mineralization style. The research area is expected to be many features typical of epithermal related low-sulfidation gold mineralization.

Conclusion

Shwegyaung-Mankat area is located about 4 km southwestern part of Banmauk Township, Katha District, Sagaing Region. The research area lies in northern continuation part of the Wuntho Massif and it is the northern segment of CVL so called Inner Volcanic Arc. Wuntho Massif lies in the Inner Burman Tertiary Basin (Central zone) which is one of the major geotectonic units of Myanmar.

Geologically, this research area is occupied by Hpyu Taung Metamorphics, Shwedaung Formation, Mawgyi Andesite, Mawlin Formation, Kanza Chaung Batholith Group, and Wabo Formation. According to the field observation, megascopic and microscopic studies, and XRF analysis, the rock units can be classified as andesite, dacite, diorite and granodiorite. Gold mineralization associated with volcanoclastic rocks of Lower Cretaceous, mineralized quartz veins in fracture zone of Hpyu Taung Metamorphics (quartz schist), and intrusive rocks of Kanza Chaung Batholith Group.

Gold-bearing quartz veins are characterized by sheeted veins, stockwork, massive, small veinlets and fracture-filling types. Mineralized quartz veins are mainly occurred along the fault and breccia zones. The vein trends have two directions are nearly N-S and NNW-SSE directions. There are two mineralization zones of gold-bearing massive quartz vein; (1) Massive quartz vein occur in Kanbat adit. It is trending NW-SE, and its dipping ranges from 38º to 65º. The thickness of vein is 0.12 to 0.3 m, and (2) Stockwork form and quartz veinlets occur in Shwekyin worksite. It is nearly N-S trending, and its dipping ranges from 55º to 59º. The thickness of vein is 0.15 m.

Type of mineralization of research area is based on the geological setting, structure control, alteration minerals assemblage, hosted rock and mineralization style. The research area is expected to be low-sulfidation epithermal deposits gold mineralization. Mineralized quartz veins are mainly hosted in andesite, schist, and diorite rocks. The veins type, ore texture and style of mineralization in Shwegyaung-Mankat area is probably later than the hosted rocks. Therefore, the age of mineralization is probably post Paleozoic time. Evidence of mineralized veins structure and ore texture, the mineralization style of research area is considered to be low-sulfidation epithermal deposits. It can be concluded that economic potential of minerals cannot be evaluated in this stage because of the lack of drill hole data.

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