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MORPHOLOGY, FIELD OBSERVATIONS AND PETROGRAPHIC DESCRIPTIONS OF GOMBAK SELANGOR QUARTZ RIDGE, HULU KLANG, SELANGOR MALAYSIA

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ABSTRACT

The Klang Gates Quartz Ridge was formally named as the Gombak Selangor Quartz Ridge (GSQR) by the Selangor State Government by 24 June 2015. It was built entirely of quartz vein formed when residual magma crystallized and consolidated within vertical slab of dyke through large linear fissures within massive granitic rock known as Kuala Lumpur Granite about 200 million years ago. The GSQR can be divided into the eastern and western section by the dam. Three type of quartz crystal growth was identified as rutile quartz growth, milky quartz and smoky quartz. The milky quartz was found dominantly at the eastern section; whilst at the western section consists of smoky and milky quartz. At least three phases of quartz vein intrusions were recognized in our survey which is identified as major phase, fault phase and minor phase. The petrography study show the most abundant mineral is quartz (> 90%), alkali feldspar and plagioclase is less than 5%, while zircon and apatite occurs as accessory mineral as inclusion in quartz crystal. Small biotite and muscovite also observed on certain sample.

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Our survey shows that the Gombak Selangor Quartz Ridge is unique not only due to panorama views of Kuala Lumpur but also on their quartz crystal grow and vein structure as an aesthetic values.

Keywords: Gombak Selangor Quartz Ridge Malaysia, Field observations, Petrography descriptions

INTRODUCTION

The Klang Gates Quartz Ridge was formally named as the Gombak Selangor Quartz Ridge (GSQR) by the Selangor State Government by 24 June 2015. It was believed as the longest quartz ridge in the world which is about 14 km long. Their wide is range between 50 m to 200 m and elevation more than 300 m from sea level. It was built entirely of quartz vein formed when residual magma crystallized and consolidated within vertical slab of dyke through large linear fissures within massive granitic rock known as Kuala Lumpur Granite about 200 million years ago.

This paper presents the morphology study and field observations of the Gombak Selangor Quartz Ridge to identify their rock type including vein structure. Detailed petrography study under microscope was conducted to identify mineral constitution and texture for each rock types.

GENERAL GEOLOGY

The GSQR is situated at Gombak District on northeast of Kuala Lumpur. The general geology surrounding the GSQR is dominant by Triassic granite (Bignell & Snelling 1977). The granite is identified as a medium to coarse-grained biotite-muscovite granite. It was part of the batholith of Main Range Granite. Other than the granitic rock, there are also metamorphic rock of Hawthornden Schists and Kuala Lumpur Limestone around the GSQR (Fig. 1).

The GSQR was formed from the crystallization of late phase magma rich in silicate oxide along the Kuala Lumpur fault zone within granite body. The age of the GSQR is Late Jurassic to Middle Cretaceous (175 to 92 Ma) based on muscovite using K/Ar age dating (Rajah et al. 1977).

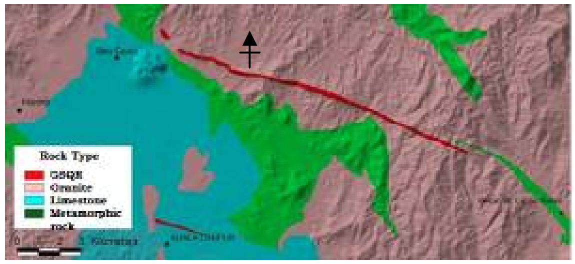

Fig.1. The general geology around the GSQR consists of Main Range Granite, Hawthornden Schists and Kuala Lumpur Limestone

The intrusion of quartz vein is repeated many times in geological history (Gobbett 1964, Tjia 1984). The weathering and erosion of granite nearby has exhibit GSQR as the unique geological monument as a huge or giant quartz vein with maximum height 534 m from sea level as measured at Bukit Tabur.

METHODOLOGY

The topography study using the remote sensing technique consists of Digital Model (DTM and DSM) data from Advanced Inter Ferometric Synthetic Aperture Radar (IFSAR). The field observation was conducted to study geomorphology process occurred that formed the rugged structure of GSQR as well as to identify rock types and structure control the vein system such as veins, fractures and faults. Similar procedure was implemented followed Mohd Rozi Umor et al. (2015).

Locations of observation station were marked for reference by GPS and samples took for petrography analysis.

The Topography and Morphology

The orientation of the GSQR is 105^0 - 285^0N in direction. It has significant correlation with Kuala Lumpur Fault structure alignment which is Northwest to Southeast direction. The ridge is 14 km length with vertical rock slope. The ridge has an undulating topography look like dragon backbone (Fig. 2). The ridge was cut by vertical fractured zones at many places formed the wind gap features, while certain areas cut cross by rivers such as Klang River, Gombak River, Tanggul River and Kemensah River (Ibrahim Komoo & Syafrina Ismail 1999).

The landscape of GSQR is very unique and outstanding. It can be divided into two section namely as eastern ridge and western ridge. The western ridge started from Klang River toward east to Gombak River, while the eastern ridge aligned from Klang River to Kemensah

River at the west (Fig. 3 & 4). The highest point of GSQR is Tabur hill located at the western ridge about 534 m from sea level. The highest point at eastern ridge is Rata hill (367 m).

Fig.2. The view part of GSQR show undulating topography look like dragon backbone.

Fig.3. The view of western ridge shows the highest point of Tabur Hill and Klang Gate dam reservoir.

Fig.4. The view from west to east shows the Rata Hill as the highest point on eastern ridge.

Based on the topography, the landscape of GSQR can be classified into four types such as dome shape, table shape, ramp shape and tower shape (Fig. 5). The dome shape is very dominant observed was formed due to homogenous fracture around the ridge. The table shape landscape is formed on massive rock with less fracture. The ramp shape is due to fault structure on one side that creates more fractures compare other side, while the tower shape was formed at highly intensive fracture.

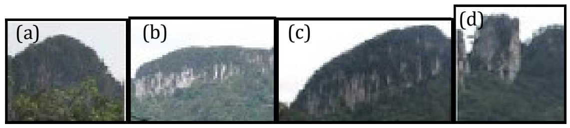

Fig.5. The landscape of GSQR (a) Dome, (b) Table (c) ramp and (d) tower.

The topography view using data DSM IFSAR (2008) with 5 m resolution was generated to show the clear topography of GSQR from its vicinity. The image was overlay inside Google Earth as show Fig 6 & 7.

Fig.6. The image DSM IFSAR overlay inside Google Earth viewed from south to the north of GSQR.

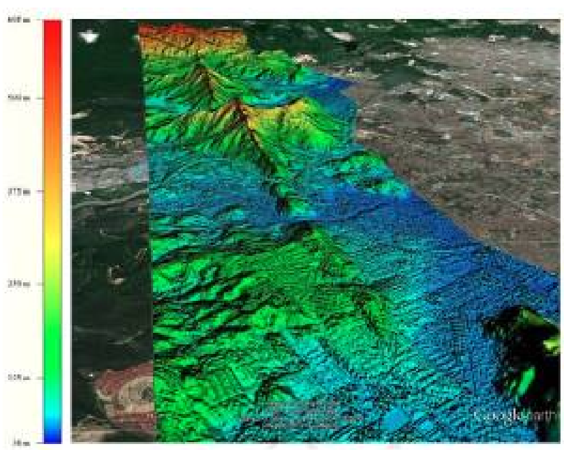

Fig.7. The image DSM IFSAR overlay inside Google Earth viewed from east to the west of GSQR.

FIELD OBSERVATIONS

In this study, we marked 61 locations as an observation stations which is 47 stations on western ridge and 14 stations on the eastern ridge. 53 samples were collected for reference and analysis consists of 38 samples from western ridge and 15 samples from eastern ridge.

The field observation emphasized on the rock type classification and geological structure especially intrusion phases of quartz vein. This information can explain the process and history of rock crystallization in GSQR.

The variety of quartz crystal

Based on our observation, the entirely rock in GSQR is classified as quartz vein. The quartz vein consists almost mainly of quartz with minor feldspar. Our observation shows that there are three variety of quartz vein can be classified based on mineral growth in GSQR. It can classify as pure and clean quartz, milky quartz and Smokey quartz. All varieties of quartz can be found on western and eastern ridges, but the most dominant is milky quartz. The smokey quartz more abundant at eastern ridge compared to western ridge.

The milky quartz was defined by homogeny white colour and has broken glass shaft texture. Based on their size, it can be specified into massive milky quartz and crystallize milky quartz. Massive milky quartz was fine-grained with no crystal shape growth, while crystallize milky quartz is showed the crystal shape. It was indicate two different cooling processes where massive milky quartz is relatively fast compared to crystallize milky quartz (Fig. 8).

The pure or clean quartz defined by perfect shape of quartz crystal formed on surface of quartz vein with size range 1 mm to 5 cm long. The perfect shape indicates the slow crystallization occurred during crystal growth (Fig. 9). It formed as tabular to needle shape. This type of quartz variety was found inside milky quartz vein usually observed on open space. Differ with crystallize milky quartz, this clean quartz was clear and transparent and usually formed as smaller crystal.

The smokey quartz only observed at certain area. It was characterized by grey colour with limited light transparent through and certain sample is dark colour. The grey colour may be due to contamination process during crystallization (Fig. 10).

Fig.8. The milky quartz which is homogenous white colour quartz consists of (a) massive milky quartz and (b) crystallize milky quartz.

Fig.9. The pure and clean quartz variety found in GSQR. It was transparent light and perfect shape crystal.

Fig.10. The pure and clean quartz variety found in GSQR. It was transparent light and perfect shape crystal.

The Quartz Vein Phases

The entirely of GSQR was built up by intrusion of quartz veins. There are three phases of intrusions can be identified based on observation.

The first phase which is considered as the major phase intrusion was aligned at 280^{0}N in strike and dip almost vertical range between 70 to 90 degrees. The orientation is parallel with GSQR alignment. This phase has quartz vein wide between 15 to 30 cm in general, and relatively thicker compared to the second and third phase intrusion. The second phase quartz vein intrusion was defined as fault quartz vein. The orientation of intrusion is in various directions but usually cross the major quartz vein intrusion almost perpendicular. The range size of this vein between 3 to 5 cm in general. The third phase is the minor quartz vein intrusion which is defined as the minor intrusion extension of major and fault veins intrusion. This minor intrusion was cross randomly and usually cross cutting the previous of major and fault intrusion vein. The relation between major, fault and minor vein intrusion was shown in

Fig 11. The major vein considered as the oldest phase intrusion followed by fault phase intrusion, and both vein intrusions lastly intruded by minor phase intrusion.

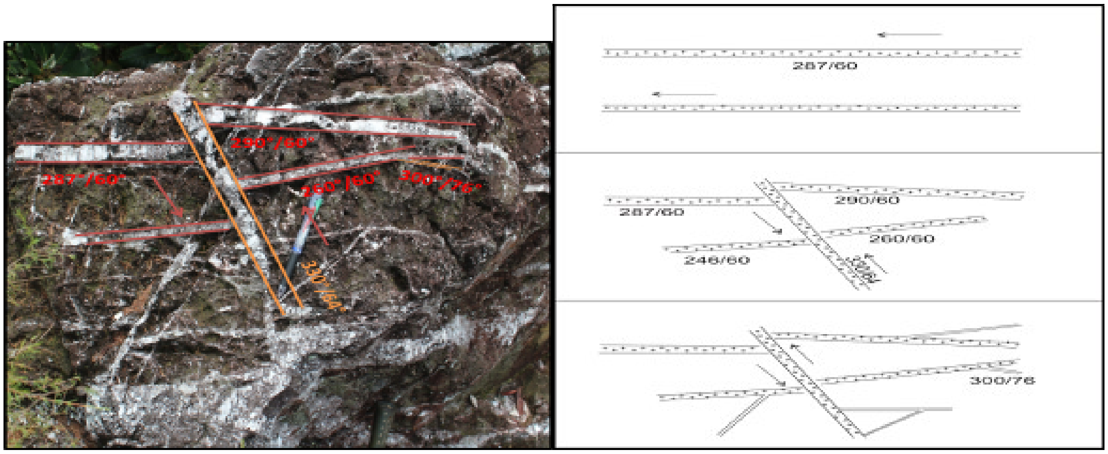

Fig.11. The major phase intrusion with $280^0/60^0$ in strike and dip was cut cross by fault phase intrusion with $330^0/64^0$ in strike and dip. The replacement is about 5 cm. The illustration show the sequence history of vein intrusion.

The fractures very common observed within quartz vein rock. The major fractures orientation is almost parallel with major quartz vein intrusion. We measured major fractures mostly at 300^0N strike and 70 degrees dipping. The minor fracture measured is 240^0N strike and dipping around 40 degrees. The intersection between fractures can cause the rock fall failure. We observed at many places the condition where two set of fractures system gives potential for rock tower to fall as shown in Fig. 12.

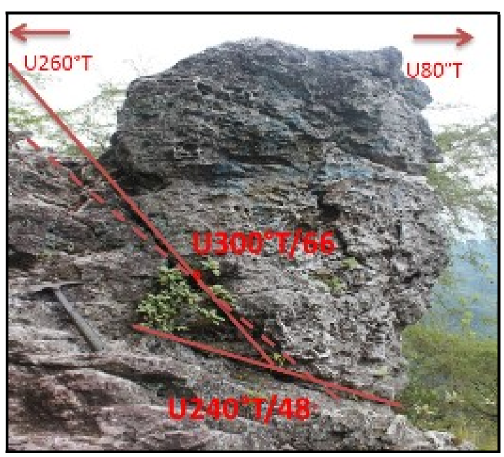

Fig.12. The two set of fracture can cause the rock fall failure was found at many places during our observation.

THE PETROGRAPHY

12 samples were analyzed under polarized microscope for petrography study. The petrography study shows mineral composition in quartz vein is 95% consists of quartz, while alkali feldspar and plagioclase about 3 to 5%. The minor accessory mineral such as muscovite, biotite, zircon and apatite also detected in some samples. The quartz in massive milky quartz vein usually fine-grained compare to sample of crystallizes milky quartz vein and pure quartz vein (Fig 13 & 14).

0.2 mm

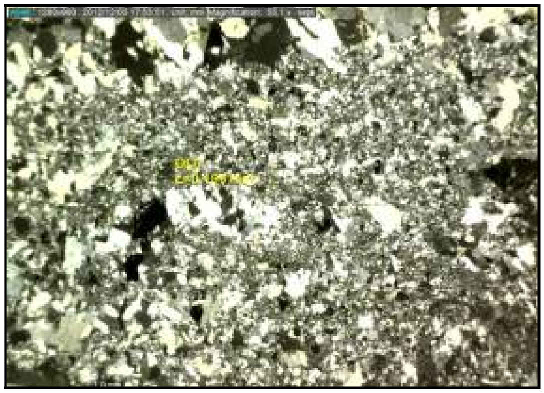

Fig.13. The microscopic view of massive milky quartz vein show fine-grained quartz as major mineral.

0.2 mm

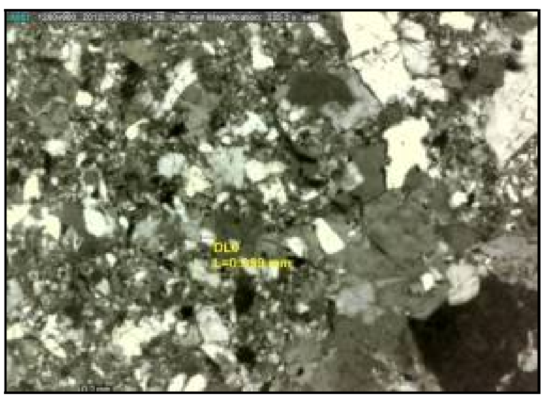

Fig.14. The microscopic view of crystallize milky quartz vein show medium to coarse-grained quartz as major mineral.

The common textures observed in the sample is micro-vein. Petrography observation shows the intrusion of micro-vein is repeated many times during crystalization (Fig 15). The micro-vein has cut cross the large quartz crystal and show eroded texture at the boundary. The late intrusion also cause the mortar texture due to stress and collision between quartz grains during intrusion (Fig. 16). Apatite is common occurred as inclusion mineral inside quartz. It can be recognized by tabular shape as needle at ecrtain sample (Fig. 17).

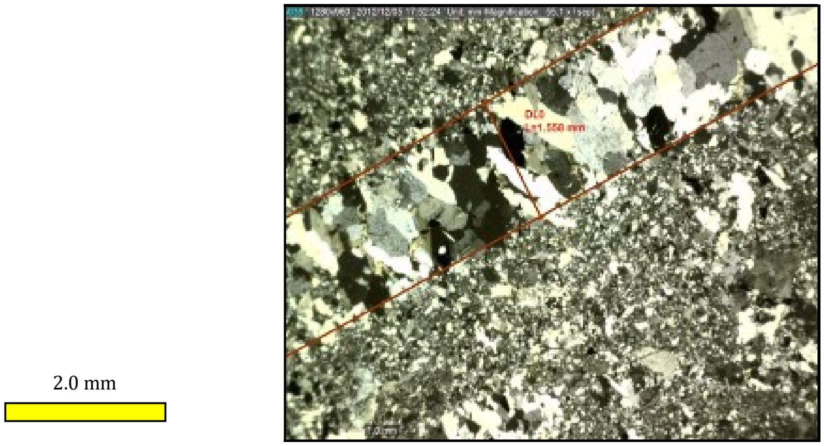

Fig.15. The microscopic view show the micro-vein intruded inside fine-grained quartz as major mineral.

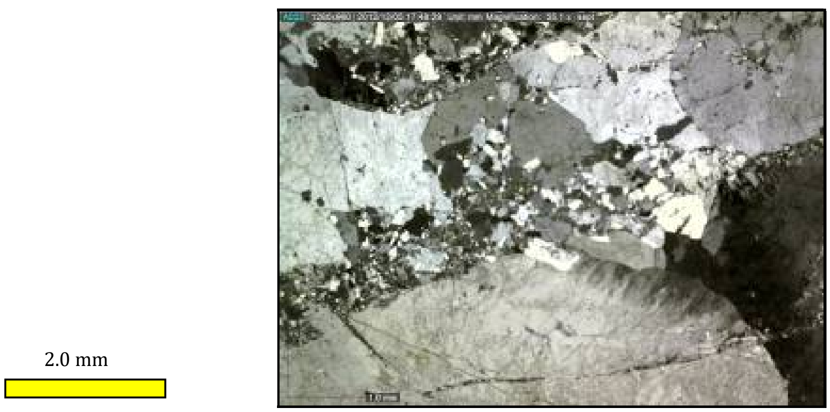

Fig.16. The microscopic view of the intrusion of micro-vein in large quartz at the bottom and the boundary show some mortar texture due to stress and collision between quartz grains.

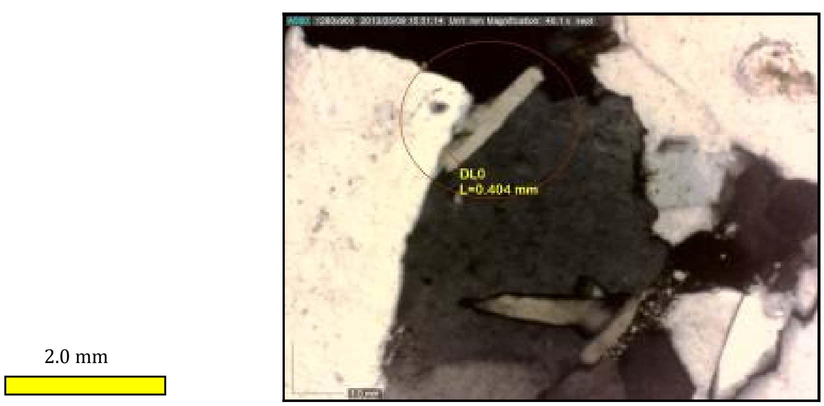

Fig.17. The microscopic view show the common accessory mineral consists of apatite charaterized by their tabular shape as inclusion in quartz.

CONCLUSIONS

The study of GSQR based on morphology, field observation and petrography revealed that it entirely consists of quartz vein as a main rock type which can be specifically classified into massive milky quartz veins, crystallize milky quartz veins, pure or clean quartz veins and smokey quartz veins. The quartz is hard and resistant to weathering process has formed the unique morphology with vertical wall and roof landscape varieties. There are at least three phases of vein intrusion identified during our observation but we believed it may be more than that. Structures such as fractures have significant contribution for rock fall failure. The mineralogy of GSQR show almost 95% of mineral content consists of quartz.

All these information shows that GSQR is very unique and need to be preserve for next generation. It is very rare geological monument with high aesthetic and intrinsic values for recreation as well as for education. We strongly suggest the GSQR be nominated as world geological heritage and classify as Outstanding Universal Value Monument.

ACKNOWLEDGMENT

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