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Geology and genesis of the Nwe Yon-Kwinthoneze Gold District, Central Myanmar: insights from mineralogical, fluid inclusions and (S, C, O, H, Pb) isotopes

ABSTRACT

The Nwe Yon-Kwinthoneze gold district is located approximately 83 km north of Mandalay City in central Myanmar. It lies within the middle segments of the Mogok Metamorphic Belt (MMB). The study area is situated between latitude 22°39'00" - 22°47'00" and longitude 95°58'00" - 96°08'00", covering an area of approximately 17 km E-W and 16.5 km N-S, with a total area of approximately 280.5 km^2.

Gold mineralisation in this gold district occurs in the high-grade metamorphic rocks of Mogok Metamorphic groups such as gneiss, marble, granite and micro-granite. Majority of the Au deposits and prospects in this gold district are temporally related proximal to distal Kabaing granite intrusion.

The wall-rock alterations are dominated by silicification, chloritization, carbonation, sericitization and pyritization, which are similar to typical intrusion-related gold and orogenic gold deposits.

More than 16 auriferous quartz veins are observed, which are NNE striking and dipping to the SE. The ore bodies are dominantly controlled by NE–SW trending compressional–shear faults. The characteristics of orebodies are especially veins, massive and disseminated auriferous quartz veins. They have the higher gold concentration (up to 400 ppm).

The Kabaing granite can be classified in the moderately reduced range (MR), characterised by low Fe_2O_3/FeO ratios and regarded as ilmenite series granitoids, which is similar to the signatures of typical reduced intrusion-related gold systems.

At least four main paragenetic mineral assemblage stages have been identified during this study. The gold fineness value in stage 2 mineralization of native gold, which is associated with sulphides, has a gold fineness value of 738-925, and native gold associated with telluride minerals has a fineness value of 858-909. The electrum in stage 3 mineralization has a relatively low gold fineness value and ranges widely from 312-796. The Au: Ag ratio at the A2 and New A2 deposits range between around 0.9:1 and 5:1. Te: Au ratio is about 0.2 to 0.9.

The newly discovered Au-Cu-(Pb-Zn) skarn alteration developed at the contact between marble and granite. The exposed rock units in this skarn prospect are dominated by Mogok metamorphic units such as white marble, diopside marble, phlogopite marble,

migmatite, calc-silicate rocks, and gneiss, which were intruded by Kabaing granite. The prograde stage is predominately characterised by grossular-rich garnet, pyroxene and vesuvianite mineral assemblages. Pyroxene is more abundant than garnet. Retrograde stage is characterized by the hydrous minerals and minor occurrence of sulphides. Chlorite is common in the retrograde stage, and epidote is less common. The sulphide stage is primarily represented by pyrite, sphalerite, chalcopyrite, galena and pyrrhotite. Gold mineralization is associated with the sulphide stage.

The chlorite temperatures obtained by using the empirical calibration range from 215° to 331° C in stage 2 chlorite and 180° to 334° C in stage 3 chlorite, respectively. Stage 2 auriferous quartz veins have homogenization temperatures of 237 to 305 °C with salinities of 6.0 - 15.1 wt.% NaCl equiv. The final ice-melting temperature (T_m) for the FIAs of stage 2 quartz veins varied from -11.1 to -3.7. Fluid inclusion assemblages in quartz-carbonate veins of stage 2 have homogenization temperatures of 246 to 283 °C with salinities of 14.0 - 16.1 wt.% NaCl equiv. and the final ice-melting temperature (T_m) of -12.1 to -10.1, respectively.

The $\delta^{34}S$ values of hydrothermal fluids of the Nwe Yon-Kwinthoneze gold district might be inherited from the magmatic sulphur as well as local host rocks. The primary source of carbon was magmatic-hydrothermal. In the $\delta^{18}O$ and δD of fluids diagram, the data are plotted within the magmatic and felsic water fields, which suggests that magmatic fluids may have played an important role during the formation of the ore-forming fluids. The Pb isotopes of galena from the study area have a narrow range and a homogeneous composition, suggesting that a single source or else a well-mixed source of Pb. The ore-forming metals at the Nwe Yon-Kwinthoneze gold district were sourced from magmatic source mixed with the local host rocks. The homogeneity of S-C-O-H-Pb isotope compositions throughout the gold district demonstrates the uniform fluids and metal source reservoirs.

Therefore, based on the characteristics of wall rocks alteration, mineralisation, mineral chemistry, and S, C, O, H, Pb isotope data, the Nwe Yon-Kwinthoneze gold district can be classified as a reduced intrusion-related gold system (IRGS).