MINERALOGICAL AND PETROLOGICAL STUDIES OF THE ROCKS OF TWINNGE-YENYA-OO AREA, THABEIKKYIN TOWNSHIP, MANDALAY DIVISION

PhD DISSERTATION

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ABSTRACT

Twinnge-Yenya-Oo area is located at the northeastern part of Thabeikkyin Township about 157 km from Mandalay and near the junction of Momeik–Twinnge and Twinnge-Tagaung motor roads. Yenya-Oo is known particularly for producing beautiful velvet blue colour sapphires.

The rock sequence of the study area consists of intrusive igneous rocks (mainly granitic and syenitic rocks) and medium to high grade metamorphic rocks, marble, calc-silicate rock and gneiss. The gneiss unit consists mainly of biotite gneiss, garnet-biotite gneiss and hornblende gneiss. This unit is well exposed at the northeastern part of the study area. Calc-silicate rock occurs at the base of Payaung Taung, Kawpon Chaung and underlying Moksoe Taung. The marble unit of the study area is subdivided into five subunits, depending upon the mineral assemblages: (1) diopside marble (2) spinel-phlogopite-forsterite marble (3) graphite–phlogopite marble (4) spinel-chondrodite marble and (5) pure marble. The skarn rocks occurred in calc-silicate rocks affected by the intrusion of biotite microgranite whereas marble is intruded by the leucogranite and syenite.

The study area had been subjected to at least two types of metamorphism. The mineral assemblages indicate that the regionally metamorphosed rocks of the area belong to the sillimanite almandine orthoclase subfacies of almandine amphibolite facies. However, they were superimposed by the subsequent contact metamorphism and later intrusions of granite and syenite locally The contact metamorphic grade reached the pyroxene hornfels facies.

The oxide-silica variation diagrams, Al_2O_3, TiO_2, Fe_2O_3, MgO, MnO,P_2O_5 and CaO show negative correlation with SiO_2. Na_2O and K_2O have positive correlation with SiO_2. Al_2O_3 content is higher in the alkali syenite pegmatite and nepheline syenite pegmatite and favours the formation of sapphire.

Al_2O_3 present in most of the igneous rocks exceeds those of Na_2O+K_2O and CaO. It indicates that the igneous rocks in the study area are peraluminous in character. A/CNK–SiO_2 relation indicates that the granitic rocks in the study area

are S-type. Na-K-Ca geochemical characteristic of granitic rocks indicate that they were of magmatic derivative origin.

The U-Pb zircon age determination indicates that the augite granite was emplaced in Jurassic-Cretaceous boundary. Leucogranite may have emplaced in the transition of subduction-collision environments in Early Cretaceous whereas the biotite microgranite may have emplaced in the post collisional plate tectonic environment.

Primary sapphires are recovered from alkali syenite pegmatites and nepheline syenite pegmatites. The secondary occurrence is recovered from alluvial placer and channel deposit at shallow depths. The great variety and high quality of gem materials are mainly recovered from the placer deposits.

Most of the large sized opaque sapphires are recovered from Kyargaung worksite, while the small sized but finer velvet blue sapphires are found at Kyauktagar worksite. Kyargaung sapphires have higher Fe_2O_3 and lower Cr_2O_3 than the Kyauktagar sapphires. Therefore Kyauktagar sapphires are more pleasing in colour than those of Kyargaung..

Inclusions of these corundums were studied by Laser Raman Spectroscope analysis. Laser Raman Spectroscopic test reveals that mineral inclusions are represented by rutile, biotite, melanophlogite, pennantite, albite and diaspore. Most of the sapphires contain needles of rutile and CO_2 sometimes as two-phase and sometimes as one-phase. It also contains detectable CH_4, healed fractures with abundant CO_2-bearing inclusions. There were also some melt inclusions with one containing possible pennantite. Sapphires also contain diaspore daughter crystals. Silicate melt inclusions are associated with carbon dioxide inclusions that would seem to indicate that corundum crystallization occurred from syenite melts. In addition, the Yenya-Oo sapphires lie within magmatic "syenitic type" corundum field of Saminpanya et al. (2000).The pressure-temperature conditions of Yenya-Oo sapphire formation may be estimated at 780°-820° C and 1.7 to 3Kbar, based on data from primary carbon dioxide and melt inclusions.

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