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Ruby-Bearing Xenoliths in Cenozoic Basalt Exposed in the Vicinity of Bo Rai Gem Deposits, Eastern Thailand

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Ruby-bearing xenoliths have been discovered in fresh basalts that are exposed in the vicinity of the Bo Rai ruby deposit, Trat Province, eastern Thailand. These crucial evidences allow us to give new insights for the origin of the Siamese (Thai) ruby. Based on age dating data, the basaltic host rock is grouped into the Cenozoic volcanism. It is geochemically characterized by high alkaline composition with normative olivine and nepheline, that can be classified as basanite. Apart from the corundum-bearing xenoliths, other types of xenoliths (e.g. ultramafic and mafic granulite) occur in the same host rock. (1) Ultramafic xenoliths contain mostly olivine, clinopyroxene, orthopyroxene and spinel. This type is similar to ultramafic xenoliths (spinel lherzolite) exposed in corundum-related basalts from other parts of Thailand. Olivines are commonly frosterite-rich; orthopyroxenes and clinopyroxenes contain little compositions of Mg-Tschermak and Ca-Tschermak, respectively; chromium contents in spinel are usually detected with various ranges. (2) Mafic granulite xenoliths are characterized by metamorphic textures, particularly granoblastic with triple junction, and contain predominantly plagioclase and clinopyroxene with accessory kelyphitic garnet; their assemblages are obviously different from ultramafic type. In addition, rare fresh garnet grains with pyrope-rich composition are also found in a few samples. Clinopyroxenes cantain much higher Ca-Tschermak than ultramafic pyroxene, while plagioclases vary from An50 to An60. (3) The last group of xenolith is recognized as transitional type that cannot be separated clearly from the former types. The mineral assemblages, chemical compositions and mineral chemistries are ranging between the ultramafic, mafic granulite and ruby-bearing xenoliths. They are significantly composed of clinopyroxene, kelyphitic garnet and spinel with or without plagioclase, olivine and orthopyroxene. In addition, some nodules also present tiny euhedral corundums. Although they have somewhat different mineral assemblage causing variety of chemical compositions, mineral chemistry of spinel existing in all transitional nodules are identical. They are characterized by

extremely high Cr spinels (av.60-65 %Cr2O3) which the Cr contents are obviously higher than those of ultramafic spinels. Ruby-bearing xenoliths contain essentially plagioclase (An90) and clinopyroxene (high Ca-Tschermak) whereas spinel and garnet are accessory minerals. Their assemblage, except ruby, is compatible with mafic granulite and some transitional type. Cr-rich spinels and pyropic garnet are chemically similar to those found in the transitional group. In addition, chemistry of these minerals are also similar to those reported from xenocryst and alluvial assemblage collected from this area, which P-T constraint of equilibration was calculated based on thermodynamic data yielding about 1150 + 100oC and 10-25 kbar. This preliminary investigation leads to a few points of conclusion. Firstly, upper mantle and perhaps lower crust beneath the eastern region of Thailand seem to be inhomogeneous indicated by the occurrence of different types of xenoliths in the same basanitic host rocks. This conclusion fits nicely into the geological frame of the area. A heterogeneous lower crust/upper mantle is proposed by a main geological suture seperating Shan-Thai block and Indochina block in eastern Thailand. Secondly, Thai rubies crystallized in Al-rich mafic granulite or related rocks before basaltic magma passed through and carried them as xenoliths to the surface. However, the origin of Thai ruby is different from origin of sapphire from the nearby Chantaburi deposit and in other places of Thailand.