# Petrogenesis of the Late Permian Plei Man Ko granite in the Kontum Massif, central Vietnam

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An acceptable model for the generation of granitic magma is partial melting of crustal materials. Experimental studies using both model and natural systems have revealed melting reactions for crustal materials under conditions of lower to middle crust. The melting reactions in metamorphic rocks were previously reported from high-grade metamorphic terranes, whereas those in igneous rocks are less understood. We found reaction texture to produce granitic melt in the Plei Man Ko granite (S-type granite) that intruded granulite facies metamorphic rocks in the Kontum Massif, Vietnam. In this paper we will describe field occurrence, petrography, mineralogy and geochemistry of the granite, and discuss partial melting process in the deep crust of the Indochina block.

The Kontum Massif is situated as a core complex in the Indochina block exposed on a mountain range of the Central Vietnam. The massif consists of both high-P and high-T metamorphic rocks that include ultrahigh-temperature metamorphic assemblages, and various kinds of igneous rocks. Recent geochronological study of the high-grade genisses and associated granites from the Kontum massif reveal that the time of granulite facies metamorphism and igneous activity would coincide with each other at around 250 Ma (Tran Ngoc Nam et al., 2000; Nagy et al, 2001; Carter et al., 2001; Osanai et al., 2001).

The Plei Man Ko Complex occurs as small stocks and lenses. The complex is composed of following rock types, 1) norite, 2) garnet granite (Grt granite), and 3) orthopyroxene granite (Opx granite). The mutual relationship between the Grt granite and the Opx granite are less understood. The Grt granite, however, is locally accompanied by the norite. The field occurrence reveals that the norite contemporaneously intrudes the Grt granite. Migmatitic signatures are locally observed in some localities, in which the Grt granite includes the pelitic granulite such as an orthopyroxene-garnet gneiss (Opx-Grt gneiss).

Garnets in the Grt granite are divided into two types, anhedral with biotite and quartz inclusions and euhedral with few inclusions. The anhedral type has high Ca contents compared with the euhedral one. The garnet in the Opx-Grt gneiss has higher Ca contents rather than former two types of garnet in the Grt granite. Anothite contents of plagioclase in the Opx-Grt gneiss are An=70 to 80. On the other hand, An contents of the Grt granite are An=20 to 30. Biotite included in the anhedral garnet shows anhedral, whereas matrix biotite in the Grt granite appears as an euhedral to subhedral shape. Fluorine contents of the inclusion biotite are higher than those of the matrix biotite regardless of their XMg values. Biotite and quartz symplectite locally replaces orthopyroxene in the Opx-Grt gneiss. Euhedral to subhedral orthopyroxene including tiny subhedral biotite is presence in the Opx-Grt gneiss. Estimated P-T conditions using geothermobarometryies of the Opx-Grt gneiss show 0.6 to 0.7 GPa and 800 to 870 degree-C. The P-T conditions cross the dehydration curve of biotite in the pelitic system. Taking texture and chemistry into account, the biotite included in the anhedral garnet would be of a residual phase at melting of the Opx-Grt gneiss by dehydration melting. The reaction texture producing granitic melt would therefore be preserved in the Opx-Grt gneiss as well as the Grt granite.

The initial Sr and Nd isotope ratios of the Opx-Grt gneiss and the Grt granite corrected by 250 m.y. range from 0.7321-0.7562 and 0.51163-0.51167 (equivalents to epsilon Nd values from -12.4 to -13.3), respectively. The isotopic data are plotted in a similar field on the epsilon diagram, supporting above mentioned petrogenetic model of the Grt granite.

The Garnet granite could be produced by crustal anatexis due to thermal effect of mantle derived basaltic magma (the norite) in terms of occurrence and petrological signature.