Heterogeneity of texture and mineral chemistry of the mantle peridotite xenolith from Mt. Oku in Cameroon volcanic line

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The Cameroon line, which is a 1,600-km volcanic chain sitting on the continental margin of West Africa, is a unique with passive margin volcanism between continental crust and oceanic crust. At this area, we can obtain upper mantle peridotites as xenolith in alkaline basalts that are generated from both the sub-oceanic and sub-continental mantle [1,2]. Here, we studied petrography and mineral chemistry of major elements of 37 mantle xenoliths from Mt. Oku area that was located on the continental region, and will discuss the petrological and chemical heterogeneity of sub-continental uppermost mantle in this area.

Most of the peridotite xenoliths in the Mt. Oku area are lherzolite composed by olivine (60-91 vol.%), orthopyroxene (6-33 vol.%), clinopyroxene (1-11 vol.%) and small amount of chromian spinel. Some peridotites include pargasitic amphibole as an accessory mineral. In the Mt. Oku area, the petrography and mineral chemistry changes systematically between southwest (e.g., Lake Enep, Befang area) and northeast (e.g., Lake Wum, Lake Nyi and Lake Nyos). From southwest to northeast, the grain size of minerals decreases, texture of lherzolite changes from protogranular to porphyroclastic, exsolution lamellae in orthopyroxene and clinopyroxene increases, mode of diopsidic clinopyroxene decreased, and mode of chromian spinel slightly increase. These petrographical features have a good correlation with mineral chemistry. Fo (= 100∗Mg/(Mg+Fe) atomic ratio) of olivine and Cr# (= Cr/(Cr+Al) atomic ratio) of spinel ranges 87.9 – 90.9 and 0.078-0.321, respectively. These values of olivine and spinel consistent with the ordinary mantle peridotite from uppermost mantle [3]. The upper limit of Fo content and Cr# of spinel in northeast area is higher than that of southwest. In northeast area, Cr and Mg contents of orthopyroxene, clinopyroxene are higher, and Al content of orthopyroxene and Al and Na content of clinopyroxene are lower. In other words, in sub-continental mantle at Mt. Oku area, incompatible elements decreased and compatible elements increased from southwest to northeast.

The modal composition and the olivine-spinel chemistry indicate that the most of lherzolite in this area is the primary mantle. Lherzolite include chromian spinel, therefore the lherzolites are mantle materials produced at the 30-80km depth (spinel stability field). The spatial heterogeneity from southwest to northeast can be explained by the difference of degree of partial melting and melt extraction processes. The systematic of mineral chemistry and modal composition indicate that the degree of partial melting is increase from southwest to northeast. Because large amount of exsolution lamellae in pyroxenes are observed in lherzolite from northeast, the temperature of uppermost mantle of northeast area was possible to be higher than that of southwest, therefore the degree of melting could be progressed.

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[2] Princivalle, 2000, Contrib Mineral Petrol, 139, 503-508
[3] Arai, S., 1992, Mineralogical Magazine, 56, 173-184