Zoned pyroxene from mafic dike in the Sør Rondane Mountains, East Antarctica

Masaaki Owada[1]; Kazuyuki Shiraishi[2]; Yasuhito Osanai[3]

[1] Dept. Earth Sci., Yamaguchi Univ.; [2] NIPR; [3] Earth Sci., Kyushu Univ.

The region comprising central to eastern Dronning Maud Land (2W to 40E), East Antarctica, is underlain by Mesoproterozoic to Cambrian metamorphic rocks and post-kinematic intrusive rocks with varied compositions. The post-kinematic mafic dikes linked to the Pan-African orogen, formation of the Gondwana supercontinent, include various types of lithologies: lamprophyre and lamproite in Muhlig-Hofmannfjella in central Dronning Maud Land and lamprophyre and high-K dolerite in the Sor Rondane Mountains in eastern Dronning Maud Land. Most of the mafic dikes have been weakly affected by low-grade metamorphism, but clearly preserve their igneous textures. The high-K dolerite from the Sor Rondane Mountains occasionally contains zoned pyroxenes. The formation of zoned pyroxene reflects various magma processes and basement rocks that are existence through the ascending magma. Therefore, the analysis of origin of the zoned pyroxene in the post-kinematic high-K dolerite provides useful information for the mantle dynamics and deep crustal materials during formation of the Gondwana supercontinent.

The zoned pyroxene is made up of colored core and clear rim. The clear rim consists of Cpx with euhedral shape indicating it is crystallized from high-K basaltic magma. The core parts of zoned pyroxene are composed mainly of Cpx but locally Opx. The zoned pyroxene with Cpx core is divided into three types, Types 1 to 3. Types 1 and 3 contain green-core Cpx but Type 2 bears Cpx core with pale brown in color. The shape of green-core Cpx in Type 1 is consistent with clear-rim Cpx and there is no reaction texture at the boundary between green-core and clear-rim. On the other hand, green-core Cpx in Type 3 shows anhedral and sieved texture containing Cpx, Pl, Hbl and Oqe. Type 2 possesses corroded core Cpx rimed by Pl and Hbl symplectite at the boundary of the clear-rim Cpx. The corroded-core Cpx occasionally contains Qtz. The Cpx core of all types has low XMg values rather than the clear-rim Cpx. The green-core Cpx in Type 1 shows the highest Na and Al values among all types and makes coherent compositions with clear-rim Cpx. Chemical composition of the Cpx core from Types 2 and 3 resemble that of Cpx in mafic granulites from the Sor Rondane Mountains. These lines of evidence suggest that green-core Cpx in Type 1 is regarded as a cognate phase that is formed by evolved melt. The inverse zonation might be caused by a sinking of crystal in a convecting magma chamber or injection of primitive magma. On the contrary, the Cpx cores from Types 2 and 3 are regarded as xenocrysts probably originated from the mafic granulite from the Sor Rondane Mountanis.

The Opx core is anhedral with reaction texture indicating disequilibrium with clear-rim Cpx, regarding an xencryst. Chemical compositions of Opx core are characterized by high Al2O3 (˜4 wt%) and CaO (˜2wt%). These chemical signatures are similar to those of Opx from Grt-bearing mafic granulites that undergo UHT metamorphism. Taking mode of occurrence and mineral chemistry into account, the Opx core is regarded as xenocrysts probably derived from UHT Grt-bearing mafic granulite beneath the Sor Rondane Mountains.