東南極リュツォ・ホルム岩体明るい岬のコランダム－角閃石コロナ：微細組織と構成鉱物の化学組成

森　祐紀，池田　剛
九州大学大学院理学府地球惑星科学専攻

Corundum - hornblende corona from Akarui Point in the Lützow-Holm Complex, East Antarctica: microstructure and chemical composition of constituent minerals

Yuki Mori and Takeshi Ikeda
Department of Earth and Planetary Sciences, Graduate School of Sciences, Kyushu University

Corona structures preserve both reactant and product minerals, which gives us information of its formation process including mass transfer. We have been investigating a corona structure developed around corundum in plagioclase-hornblende gneiss found in Akarui Point of the Lützow-Holm Complex, East Antarctica. We consider that the corona was formed by reaction between corundum and hornblende, as judged from its texture. Paragenetic relation before and after corona formation is described as hornblende + corundum + spinel = sapphirine + plagioclase + H_2O-fluid in the simplified system. This reaction, however, contradicts with the microstructure such that spinel is a product. Here, we report microstructure and chemical composition of main constituent minerals, i. e., corundum, spinel, sapphirine, plagioclase, hornblende and cummingtonite which will be taken into account to infer the corona forming reaction.

Microstructure

All corundum grains in this rock are surrounded by corona composed of spinel, sapphirine and plagioclase. These minerals are regularly arranged from corundum to the matrix. Corundum grain is red in hand specimen. Spinel is green and sapphirine shows pleochroism of pale blue to colorless.

In the matrix, hornblende, plagioclase, spinel and cummingtonite occur together with minor sapphirine, biotite and opaque minerals. Plagioclase grains show polygonal shape and range from 0.7 to 1.2 mm in size. Hornblende and cummingtonite are approximately 1 cm long in maximum. Hornblende is mostly blue green to pale green and cummingtonite is pale brown. Spinel is deep green and approximately 150 μm in size. Plagioclase includes rounded spinel and sapphirine with 70 - 110 μm size that are often closely associated with each other. Some coarse spinel grains (340 μm in maximum) are included in hornblende.

Chemical composition

The chemical compositions were obtained from thin section with EPMA (JEOL JXA-8530F) equipped with wavelength dispersive X-ray spectrometers (WDS) at Kyushu University.

Corundum contains small amount of Fe^{3+} (0.01 – 0.02 apfu on the basis of 3 oxygen). Cr content of spinel in the corona is as low as 0.00 – 0.01 apfu on the basis of 4 oxygen, while that in the matrix and inclusion of amphibole and plagioclase is 0.08 – 0.26 apfu. X_{Mg} (=Mg/(Mg+Fe^{2+})) of spinel ranges from 0.66 to 0.71 in the corona, and from 0.56 to 0.66 in the matrix and inclusion. Y_{Al} (=Al/(Al+Cr+Fe^{3+})) ranges from 0.96 to 0.99 in the corona, and from 0.82 to 0.95 in the matrix and inclusion. X_{Mg} shows negative correlation to Y_{Al} in the corona, while X_{Mg} shows positive correlation to Y_{Al} in the matrix and inclusion. These chemical variations can not be correlated with microstructure. In sapphirine, Si content increases and Al content decreases from inner to outer (toward plagioclase) in the corona. Sapphirine which occurs in the matrix and as inclusion has higher Si and lower Al than sapphirine in the corona. These variations are explained by Tschermak substitution. X_{Mg} of sapphirine ranges from 0.90 to 0.98 in the corona, and from 0.91 to 0.96 in the matrix and inclusion. Anorthite content (=100*Ca/(Ca+Na+K)) ranges from 78 to 90 in the corona, and does so from 80 to 87 in the matrix. It decreases from inner to outer (toward amphibole) in the corona. X_{Mg} of hornblende and cummingtonite have same ranges from 0.80 to 0.83. Ca content of hornblende ranges from 1.57 to 1.84 apfu on the basis of 23 oxygen. Al content of hornblende and cummingtonite range from 2.52 to 2.80 apfu, and from 2.95 to 3.27 apfu, respectively.

Sapphirine and plagioclase in the corona show a significant gradient of Al and Si. This suggests that this gradient controlled corona formation and zonal arrangement.