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　−単純系での定性的解析−

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Corundum-hornblende corona from Akarui Point in the Lützow-Holm Complex, East Antarctica : A qualitative analysis in the simplified sytsem

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We report corundum-hornblende coronas in plagioclase-hornblende (gabbroic) gneisses and corundum-hornblende (ultramafic) gneisses from Akarui Point, Lützow-Holm Complex, East Antarctica. Both rock-types contain corundum that is surrounded in turn by spinel, sapphirine and plagioclase. This microstructure indicates that corundum reacted with hornblende in the matrix. Among endmembers of these minerals, there is the following stoichiometric relation in the simplified CaO-MgO-Al_2O_3-SiO_2-H_2O system,

Corundum + Hornblende + Spinel = Sapphirine + Plagioclase + Vapor. (1)

Choice of tremolite instead of tschermakite and that of (221) sapphirine instead of (793) sapphirine do not change the above relation. This relation, however, can not explain the microstructure such that spinel was formed as a product of the corona-forming reaction. Nevertheless, the minerals in the left-hand-side of Eq. (1) are inferred to be stable before the corona formation, whereas those in the right-hand-side are in direct contact with each other in the coronas, suggesting that the difference in pressure-temperature condition before and after the corona formation may be described by Eq. (1).

We constructed a Schreinemakers' net by adding a possibly stable phase, sillimanite. Six univariant reactions emanate from an invariant point, among which [Sil] corresponds to Eq. (1). Other reactions are as follows:

Hornblende + Corundum = Plagioclase + Spinel + Sillimanite + Vapor [Spr],
Hornblende + Spinel + Sillimanite = Sapphirine + Plagioclase + Vapor [Crn],
Hornblende + Corundum = Sapphirine + Sillimanite + Plagioclase + Vapor [Spl] and
Spinel + Sillimanite = Sapphirine + Corundum [Hbl, Pl, V].

The association of hornblende and corundum is stable between [Spr] and [Spl]. In contrast, sapphirine coexists with plagioclase between [Spl] and [Crn]. Suppose that the peak metamorphic condition sits between [Spr] and [Sil] where the assemblage of hornblende + corundum + spinel is stable, and that the coexisting fluid is undersaturated with respect to sillimanite. Decreasing pressure, possibly also temperature, causes the reaction [Sil]. Direct contact of corundum and hornblende is destabilized by [Spl]. The spatial distribution of the products is sapphirine and plagioclase to be around corundum in this order, because sillimanite is dissolved. Further decrease in pressure causes the reaction [Hbl, Pl, V], which produces spinel between corundum and sapphirine. The produced sillimanite is again dissolved. The alternative process that passes on the another side of the invariant point requires reaction [Crn] to produce sapphirine. However, sillimanite is reactant in [Crn], which is not present based on the present assumption. Mori and Ikeda (2016) consider that the space occupied by spinel and sapphirne was originally a single phase either spinel or sapphirine based on the microstructure such that cracks continue only spinel and sapphirine. Theyremained two possible processes depending on which was firstly present. The qualitative analysis of this study proposes that the first products between corundum and hornblende were sapphirine and plagioclase. Further change of pressure and temperature caused another reaction [Hbl] that produced spinel between corundum and sapphirine.

References

Mori Y. and Ikeda T., Formation of corona around corundum in the Lützow-Holm Complex, East Antarctica. Annual meeting of Japan Geoscience Union, 2016.