

EXPERIMENTAL STUDY OF THE SYENITIC ROCKS FROM
THE YAMATO AND SØR RONDANE MOUNTAINS,
EAST ANTARCTICA (ABSTRACT)

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The melting relationships of five syenites from the Yamato and Sør Rondane Mountains were determined in the temperature range of 650–850°C, under the water pressure of 1–2 kbar and oxygen fugacities of the FMQ buffer.

The syenites studied are samples from the Yamato Mountains (Nos. 73120904:Y904 and 73120405:Y405) and from the Sør Rondane Mountains (Nos. 85012101A:SR-A, 85012103B:SR-B and 85012103C:SR-C). They are composed of porphyritic K-feldspar, plagioclase, quartz, biotite, Ca-amphibole or Ca-Na amphibole, clinopyroxene, sphene, ilmenite and rarely magnetite. Though the syenites from both regions consists of the same mineral assemblages, the compositions of amphiboles are various as follows; Ca-amphibole in the syenite (Y904) from the Yamato Mountains is close to edenitic. On the other hand, the bluish green hornblende in the mafic layer (SR-B) and the leucocratic layer (SR-C) from the Sør Rondane Mountains is richteritic actinolite. In the porphyritic syenite (Y405) and the leucocratic syenite (SR-A) intruding the layered syenites (SR-B and SR-C), the Ca-amphibole is pargasitic hornblende.

The solidus temperatures of the syenites from the Sør Rondane Mountains are about 770°C at 1 kbar. With increasing temperature, plagioclase (albite) and quartz disappeared in the lower temperature range than K-feldspar, hornblende, biotite and clinopyroxene. Clinopyroxene, biotite and K-feldspar are stable at 850°C under the water pressure of 1 kbar. Richteritic actinolite in two layered syenites (SR-B and SR-C) becomes unstable at slightly higher temperature than solidus at 1 kbar. Pargasitic hornblende from syenite (SR-A) is stable at 825°C and 1 kbar, and it disappears at 775°C and 1.7 kbar.

Representative results of syenites from the Yamato Mountains at 1 kbar are: clinopyroxene quartz syenite (Y904) begins to melt at 680°C, quartz and plagioclase disappear at 710°C, edenitic hornblende disappears at 775°C, K-feldspar disappears at 825°C, clinopyroxene hornblende quartz syenite (Y405) begins to melt at 760°C, plagioclase and quartz disappear at 780°C, K-feldspar disappears at 830°C, hornblende appears at 850°C. In both rocks, clinopyroxene and biotite remain at 850°C.

The composition of edenitic hornblende shifts to actinolite-pargasite join with increasing temperature under water pressure. The result suggests that edenite end member is unstable under high water pressure in a preliminary synthesized experiment. Pargasitic hornblende from two syenites (SR-A and Y405) are both stable at 825°C and 1 kbar. At 1.6 kbar the hornblende (Y405) is stable at 825°C, while the other hornblendes is unstable at 800°C.

All rocks investigated are at least 40% melted at temperatures 50°C above the solidus. The approximate K-feldspar content of the syenite is about 30%. The compositions of K-feldspar are Ab₄₀Or₆₀ and Ab₅Or₉₅ at 800°C and 700°C, respectively. As compared to biotite, the behavior of K-feldspar is important to concentrate K₂O content of syenite.

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