

Hydration of crust through brittle fractures: Example from Sor Rondane Mountains, East Antarctica

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Arc lower crust is expected to be amphibolite from its seismic velocity, and such lithology contains abundant hydrous minerals. However, the amount and mechanisms for supply of H₂O fluid to arc crust are not well constrained. Pervasive flow and channeling flow are the two mechanisms for the transfer of fluid in the crust. As grain boundaries are closed for crustal P-T condition, channeling flow accompanied by brittle fracture is expected. To investigate the role of brittle fracture to the supply of H₂O fluid for crust, crust-melt hydration reaction was investigated at Sor Rondane Mountains, East Antarctica.

In the survey area, biotite-hornblende-peridotite is intruded by numerous granitic brittle dykes, and reaction zones occurs at the boundaries (Fig. 1). The mineral assemblages indicate that the reaction has occurred under lower crustal P-T condition, thus the area is suitable for investigating both mechanical and physical aspects of fluid-rock interactions under the lower crustal condition. Four reaction zones are identified from the granitic dyke to the host rock as follows:

i) granitic dyke

[quartz + plagioclase + K-feldspar + biotite + rutile + zircon ± muscovite]

ii) hornblende-tremolite zone

[hornblende + tremolite ± quartz ± apatite ± biotite]

iii) tremolite-biotite zone

[tremolite + biotite + spinel ± hornblende ± pyroxene]

iv) biotite-hornblende-peridotite

[olivine + orthopyroxene + biotite + hornblende + Cr-spinel ± magnetite ± apatite]

Those reaction zones are product of hydration reactions of host peridotite with H₂O liberated from granitic melt. From plagioclase in granitic dyke and adjoining hornblende, the temperature of those reactions is estimated^[1] to be 700 °C.

The amount of H₂O liberated from the granitic melt will be quantified by the modes of hydrous minerals formed at the reaction zones. Accordingly, the amount of H₂O supplied thorough hydrous melts, and the mechanisms for transport of H₂O and hydration of the crust will be discussed.

Keywords: geofluid, brittle fractures, melt, hydration reaction, fluid-rock interaction, Antarctica

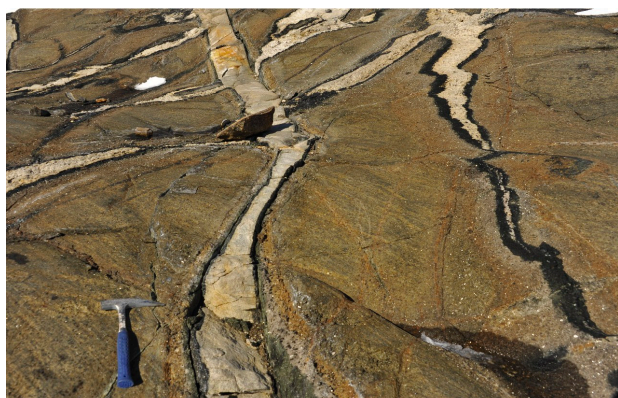


Fig. 1 Biotite-hornblende-peridotite (brown) intruded by granitic dykes (white), Sor Rondane Mountains, East Antarctica. Note that reaction zones occur at the boundary: green or black layers are hornblende-tremolite zone and grey to reddish brown layers are tremolite-biotite zone.