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SCG082-05 Room: Exibition hall 7 subroom 2 Time: May 24 10:00-10:15

TiO2 solubility of garnet coexsiting with orthopyroxene, quartz and rutile at high-P and high-T

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I wolud like to propose the Ti-in-garnet geothermobarometer for ultrahigh-temperature granulites calibrated from the experimentally reversed data of Ti content in garnet coexisting with orthopyroxene, quartz and rutile at pressures 7-23 kbar and temperatures 800-1300C in the two Antarctic granulite systems. The Ti would substitute for the tetrahedral Si in the Ca-poor garnet under the ultrahigh-temperature metamorphic conditions by the reaction:
$M_3Al_2Si_3O_{12}(Grt) + 3TiO_2(Rt) = M_3Al_2Ti_3O_{12}(Grt) + 3SiO_2(Qtz)$,
where M is Mg or Fe, whereas I could not find the positive evidence of the coupled substitution of *-Ti (* is a vacancy) for M-M in triangular-dodecahedral sites of garnet under the ultrahigh-temperature metamorphic conditions.
The TiO_2content of garnet increases with temperature and pressure given by the following equation:
$-7613 - 0.944T + 81.54P = T\ln (X_{Ti}/X_{Si}$,
where X is the mole fraction of Ti or Si on the tetrahedral site of garnet, and temperature and pressure are given in Kelvin and kbar, respectively. Titanium solubility in garnet is not so sensitive to pressure change as compared with temperature dependence given by
$-9088 + 0.985T = T\ln(X_{Ti}/X_{Si})$,
which is available to estimate metamorphic temperatures at pressures around 14 kbar.
Applying the present geothermobarometer to Ti contents of garnets in the leucocratic garnet-sillimanite gneiss from Rundvagshetta, Lutzow-Holm Complex and the orthopyroxene granulite from McIntyre Island, Napier Complex, we evaluate the retrograde metamorphic conditions of these ultrahigh-temperature metamorphic rocks as 6.6 kbar/833C and 10.3 kbar/928C, respectively. The result is consistent with those of our previous estimates.

Keywords: Ti solubility, garnet, quartz, rutile, geothermobarometer, ultrahigh-temperature granulites