Coronal reaction textures in garnet amphibolites of the Llano Uplift

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For deposit: Table 6

EQUATIONS USED IN STEADY-DIFFUSION MODELS

[This table is intended for the data repository rather than for publication in the journal itself.]

In this table, notation follows that of Joesten (1977), as extended for boundary fluxes by Johnson and Carlson (1990). Superscripts identifying interfaces between layers (e.g. '2-3') refer to layer numbers indicated by a header at the beginning of each set of equations. Mineral abbreviations are as follows: : 'Alm' = almandine; 'Aug' = augite; 'Hbl' = magnesiohornblende; 'Hyp' = hypersthene and ferrohypersthene; 'Lab' = labradorite; 'Mag' = magnetite; ; 'Prg' = ferroan pargasite; 'Olg' = oligoclase; 'Omp' = omphacite; 'Qtz' = quartz.

In the boundary-flux equations, fluxes determined from the material balance have been assigned entirely to the outer boundary of the reaction band; i.e., the fluxes across the contact with the central garnet crystal have been taken as zero.

EQUATIONS USED IN STEADY-DIFFUSION MODEL OF GARNET-QUARTZ CORONA

$$\text{Alm} \mid \text{Olg} + \text{Mag} \mid \text{Hyp} + \text{Aug} \mid \text{Qtz}$$
$$1 \mid \quad 2 \quad \mid \quad 3 \quad \mid 4$$
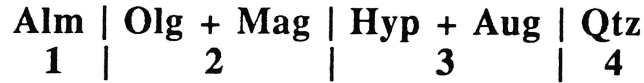
Material-Balance Equations

$$v_{SiO_2}^{1\text{-}2} + 3.00\, v_{Alm}^{1\text{-}2} + 2.75\, v_{Olg}^{1\text{-}2} + 0.00\, v_{Mag}^{1\text{-}2} = 0$$

$$v_{AlO_{3/2}}^{1\text{-}2} + 1.96\, v_{Alm}^{1\text{-}2} + 1.25\, v_{Olg}^{1\text{-}2} + 0.00\, v_{Mag}^{1\text{-}2} = 0$$

$$v_{FeO}^{1\text{-}2} + 1.63\, v_{Alm}^{1\text{-}2} + 0.00\, v_{Olg}^{1\text{-}2} + 3.00\, v_{Mag}^{1\text{-}2} = 0$$

$$v_{MgO}^{1\text{-}2} + 0.49\, v_{Alm}^{1\text{-}2} + 0.00\, v_{Olg}^{1\text{-}2} + 0.00\, v_{Mag}^{1\text{-}2} = 0$$

$$v_{CaO}^{1\text{-}2} + 0.67\, v_{Alm}^{1\text{-}2} + 0.25\, v_{Olg}^{1\text{-}2} + 0.00\, v_{Mag}^{1\text{-}2} = 0$$

$$v_{SiO_2}^{2\text{-}3} + 2.75\, v_{Olg}^{2\text{-}3} + 0.00\, v_{Mag}^{2\text{-}3} + 1.99\, v_{Hyp}^{2\text{-}3} + 2.00\, v_{Aug}^{2\text{-}3} = 0$$

$$v_{AlO_{3/2}}^{2\text{-}3} + 1.25\, v_{Olg}^{2\text{-}3} + 0.00\, v_{Mag}^{2\text{-}3} + 0.01\, v_{Hyp}^{2\text{-}3} + 0.03\, v_{Aug}^{2\text{-}3} = 0$$

$$v_{FeO}^{2\text{-}3} + 0.00\, v_{Olg}^{2\text{-}3} + 3.00\, v_{Mag}^{2\text{-}3} + 0.99\, v_{Hyp}^{2\text{-}3} + 0.36\, v_{Aug}^{2\text{-}3} = 0$$

$$v_{MgO}^{2\text{-}3} + 0.00\, v_{Olg}^{2\text{-}3} + 0.00\, v_{Mag}^{2\text{-}3} + 0.92\, v_{Hyp}^{2\text{-}3} + 0.70\, v_{Aug}^{2\text{-}3} = 0$$

$$v_{CaO}^{2\text{-}3} + 0.25\, v_{Olg}^{2\text{-}3} + 0.00\, v_{Mag}^{2\text{-}3} + 0.03\, v_{Hyp}^{2\text{-}3} + 0.85\, v_{Aug}^{2\text{-}3} = 0$$

$$v_{SiO_2}^{3-4} + 1.99\, v_{Hyp}^{3-4} + 2.00\, v_{Aug}^{3-4} + 1.00\, v_{Qtz}^{3-4} = 0$$

$$v_{AlO_{3/2}}^{3-4} + 0.01\, v_{Hyp}^{3-4} + 0.03\, v_{Aug}^{3-4} + 0.00\, v_{Qtz}^{3-4} = 0$$

$$v_{FeO}^{3-4} + 0.99\, v_{Hyp}^{3-4} + 0.36\, v_{Aug}^{3-4} + 0.00\, v_{Qtz}^{3-4} = 0$$

$$v_{MgO}^{3-4} + 0.92\, v_{Hyp}^{3-4} + 0.70\, v_{Aug}^{3-4} + 0.00\, v_{Qtz}^{3-4} = 0$$

$$v_{CaO}^{3-4} + 0.03\, v_{Hyp}^{3-4} + 0.85\, v_{Aug}^{3-4} + 0.00\, v_{Qtz}^{3-4} = 0$$

Steady-Diffusion (Conservation) Equations

$$J_{SiO_2}^{Alm} + J_{SiO_2}^{Olg} + J_{SiO_2}^{Mag} + v_{SiO_2}^{1-2} = 0$$

$$J_{AlO_{3/2}}^{Alm} + J_{AlO_{3/2}}^{Olg} + J_{AlO_{3/2}}^{Mag} + v_{AlO_{3/2}}^{1-2} = 0$$

$$J_{FeO}^{Alm} + J_{FeO}^{Olg} + J_{FeO}^{Mag} + v_{FeO}^{1-2} = 0$$

$$J_{MgO}^{Alm} + J_{MgO}^{Olg} + J_{MgO}^{Mag} + v_{MgO}^{1-2} = 0$$

$$J_{CaO}^{Alm} + J_{CaO}^{Olg} + J_{CaO}^{Mag} + v_{CaO}^{1-2} = 0$$

$$J_{SiO_2}^{Olg} + J_{SiO_2}^{Mag} + J_{SiO_2}^{Hyp} + J_{SiO_2}^{Aug} + v_{SiO_2}^{2-3} = 0$$

$$J_{AlO_{3/2}}^{Olg} + J_{AlO_{3/2}}^{Mag} + J_{AlO_{3/2}}^{Hyp} + J_{AlO_{3/2}}^{Aug} + v_{AlO_{3/2}}^{2-3} = 0$$

$$J_{FeO}^{Olg} + J_{FeO}^{Mag} + J_{FeO}^{Hyp} + J_{FeO}^{Aug} + v_{FeO}^{2-3} = 0$$

$$J_{MgO}^{Olg} + J_{MgO}^{Mag} + J_{MgO}^{Hyp} + J_{MgO}^{Aug} + J_{MgO}^{2-3} = 0$$

$$J_{CaO}^{Olg} + J_{CaO}^{Mag} + J_{CaO}^{Hyp} + J_{CaO}^{Aug} + v_{CaO}^{2-3} = 0$$

$$J_{SiO_2}^{Hyp} + J_{SiO_2}^{Aug} + J_{SiO_2}^{Qtz} + v_{SiO_2}^{3-4} = 0$$

$$J_{AlO_{3/2}}^{Hyp} + J_{AlO_{3/2}}^{Aug} + J_{AlO_{3/2}}^{Qtz} + v_{AlO_{3/2}}^{3-4} = 0$$

$$J_{FeO}^{Hyp} + J_{FeO}^{Aug} + J_{FeO}^{Qtz} + v_{FeO}^{3-4} = 0$$

$$J_{MgO}^{Hyp} + J_{MgO}^{Aug} + J_{MgO}^{Qtz} + v_{MgO}^{3-4} = 0$$

$$J_{CaO}^{Hyp} + J_{CaO}^{Aug} + J_{CaO}^{Qtz} + v_{CaO}^{3-4} = 0$$

Flux-Ratio Equations

$$2.75\, J_{SiO_2}^{Olg} + 1.25\, J_{AlO_{3/2}}^{Olg}\left(\frac{L_{Si}}{L_{Al}}\right) + 0.00\, J_{FeO}^{Olg}\left(\frac{L_{Si}}{L_{Fe}}\right) + 0.00\, J_{MgO}^{Olg}\left(\frac{L_{Si}}{L_{Mg}}\right) + 0.25\, J_{CaO}^{Olg}\left(\frac{L_{Si}}{L_{Ca}}\right) = 0$$

$$0.00\, J_{SiO_2}^{Mag} + 0.00\, J_{AlO_{3/2}}^{Mag}\left(\frac{L_{Si}}{L_{Al}}\right) + 3.00\, J_{FeO}^{Mag}\left(\frac{L_{Si}}{L_{Fe}}\right) + 0.00\, J_{MgO}^{Mag}\left(\frac{L_{Si}}{L_{Mg}}\right) + 0.00\, J_{CaO}^{Mag}\left(\frac{L_{Si}}{L_{Ca}}\right) = 0$$

$$1.99\, J_{SiO_2}^{Hyp} + 0.01\, J_{AlO_{3/2}}^{Hyp}\left(\frac{L_{Si}}{L_{Al}}\right) + 0.99\, J_{FeO}^{Hyp}\left(\frac{L_{Si}}{L_{Fe}}\right) + 0.92\, J_{MgO}^{Hyp}\left(\frac{L_{Si}}{L_{Mg}}\right) + 0.03\, J_{CaO}^{Hyp}\left(\frac{L_{Si}}{L_{Ca}}\right) = 0$$

$$2.00\, J_{SiO_2}^{Aug} + 0.03\, J_{AlO_{3/2}}^{Aug}\left(\frac{L_{Si}}{L_{Al}}\right) + 0.36\, J_{FeO}^{Aug}\left(\frac{L_{Si}}{L_{Fe}}\right) + 0.70\, J_{MgO}^{Aug}\left(\frac{L_{Si}}{L_{Mg}}\right) + 0.85\, J_{CaO}^{Aug}\left(\frac{L_{Si}}{L_{Ca}}\right) = 0$$

Boundary-Flux Equations

$$J^{Alm}_{SiO_2} = 0 \qquad\qquad J^{Qtz}_{SiO_2} = 0.82$$

$$J^{Alm}_{Al_2O_3} = 0 \qquad\qquad J^{Qtz}_{Al_2O_3} = 0.58$$

$$J^{Alm}_{FeO} = 0 \qquad\qquad J^{Qtz}_{FeO} = 0.43$$

$$J^{Alm}_{MgO} = 0 \qquad\qquad J^{Qtz}_{MgO} = -0.21$$

$$J^{Alm}_{CaO} = 0 \qquad\qquad J^{Qtz}_{CaO} = 0.07$$

Extent-of-Reaction Equation

$$v^{1-2}_{Alm} = 1$$

EQUATIONS USED IN STEADY-DIFFUSION MODEL OF GARNET-OMPHACITE CORONA

$$\text{Alm} \mid \text{Lab} + \text{Prg} \mid \text{Hyp} + \text{Olg} + \text{Hbl} \mid \text{Omp}$$
$$1 \mid 2 \mid 3 \mid 4$$

Material-Balance Equations

$$v^{1\text{-}2}_{SiO_2} + 3.00\ v^{1\text{-}2}_{Alm} + 2.40\ v^{1\text{-}2}_{Lab} + 6.08\ v^{1\text{-}2}_{Prg} = 0$$

$$v^{1\text{-}2}_{AlO_{3/2}} + 1.98\ v^{1\text{-}2}_{Alm} + 1.60\ v^{1\text{-}2}_{Lab} + 2.50\ v^{1\text{-}2}_{Prg} = 0$$

$$v^{1\text{-}2}_{FeO} + 1.66\ v^{1\text{-}2}_{Alm} + 0.00\ v^{1\text{-}2}_{Lab} + 1.66\ v^{1\text{-}2}_{Prg} = 0$$

$$v^{1\text{-}2}_{MgO} + 0.78\ v^{1\text{-}2}_{Alm} + 0.00\ v^{1\text{-}2}_{Lab} + 2.64\ v^{1\text{-}2}_{Prg} = 0$$

$$v^{1\text{-}2}_{CaO} + 0.58\ v^{1\text{-}2}_{Alm} + 0.60\ v^{1\text{-}2}_{Lab} + 1.79\ v^{1\text{-}2}_{Prg} = 0$$

$$v^{1\text{-}2}_{NaO_{1/2}} + 0.00\ v^{1\text{-}2}_{Alm} + 0.40\ v^{1\text{-}2}_{Lab} + 0.83\ v^{1\text{-}2}_{Prg} = 0$$

$$v^{2\text{-}3}_{SiO_2} + 2.40\ v^{2\text{-}3}_{Lab} + 6.08\ v^{2\text{-}3}_{Prg} + 1.99\ v^{2\text{-}3}_{Hyp} + 2.77\ v^{2\text{-}3}_{Olg} + 6.69\ v^{2\text{-}3}_{Hbl} = 0$$

$$v^{2\text{-}3}_{AlO_{3/2}} + 1.60\ v^{2\text{-}3}_{Lab} + 2.50\ v^{2\text{-}3}_{Prg} + 0.02\ v^{2\text{-}3}_{Hyp} + 1.23\ v^{2\text{-}3}_{Olg} + 1.59^{2\text{-}3}_{Hbl} = 0$$

$$v^{2\text{-}3}_{FeO} + 0.00\ v^{2\text{-}3}_{Lab} + 1.66\ v^{2\text{-}3}_{Prg} + 0.78\ v^{2\text{-}3}_{Hyp} + 0.00\ v^{2\text{-}3}_{Olg} + 1.48\ v^{2\text{-}3}_{Hbl} = 0$$

$$v^{2\text{-}3}_{MgO} + 0.00\ v^{2\text{-}3}_{Lab} + 2.64\ v^{2\text{-}3}_{Prg} + 1.19\ v^{2\text{-}3}_{Hyp} + 0.00\ v^{2\text{-}3}_{Olg} + 3.02\ v^{2\text{-}3}_{Hbl} = 0$$

$$v^{2\text{-}3}_{CaO} + 0.60\ v^{2\text{-}3}_{Lab} + 1.79\ v^{2\text{-}3}_{Prg} + 0.02\ v^{2\text{-}3}_{Hyp} + 0.23\ v^{2\text{-}3}_{Olg} + 1.81\ v^{2\text{-}3}_{Hbl} = 0$$

$$v^{2\text{-}3}_{NaO_{1/2}} + 0.40\ v^{2\text{-}3}_{Lab} + 0.83\ v^{2\text{-}3}_{Prg} + 0.00\ v^{2\text{-}3}_{Hyp} + 0.77\ v^{2\text{-}3}_{Olg} + 0.63\ v^{2\text{-}3}_{Hbl} = 0$$

$$v_{SiO_2}^{3-4} + 1.99\ v_{Hyp}^{3-4} + 2.77\ v_{Olg}^{3-4} + 6.69\ v_{Hbl}^{3-4} + 2.00\ v_{Omp}^{3-4} = 0$$

$$v_{AlO_{3/2}}^{3-4} + 0.02\ v_{Hyp}^{3-4} + 1.23\ v_{Olg}^{3-4} + 1.59\ v_{Hbl}^{3-4} + 0.35\ v_{Omp}^{3-4} = 0$$

$$v_{FeO}^{3-4} + 0.78\ v_{Hyp}^{3-4} + 0.00\ v_{Olg}^{3-4} + 1.48\ v_{Hbl}^{3-4} + 0.17\ v_{Omp}^{3-4} = 0$$

$$v_{MgO}^{3-4} + 1.19\ v_{Hyp}^{3-4} + 0.00\ v_{Olg}^{3-4} + 3.02\ v_{Hbl}^{3-4} + 0.51\ v_{Omp}^{3-4} = 0$$

$$v_{CaO}^{3-4} + 0.02\ v_{Hyp}^{3-4} + 0.23\ v_{Olg}^{3-4} + 1.81\ v_{Hbl}^{3-4} + 0.58\ v_{Omp}^{3-4} = 0$$

$$v_{NaO_{1/2}}^{3-4} + 0.00\ v_{Hyp}^{3-4} + 0.77\ v_{Olg}^{3-4} + 0.63\ v_{Hbl}^{3-4} + 0.38\ v_{Omp}^{3-4} = 0$$

Steady-Diffusion (Conservation) Equations

$$J_{SiO_2}^{Alm} + J_{SiO_2}^{Lab} + J_{SiO_2}^{Prg} + v_{SiO_2}^{1-2} = 0$$

$$J_{AlO_{3/2}}^{Alm} + J_{AlO_{3/2}}^{Lab} + J_{AlO_{3/2}}^{Prg} + v_{AlO_{3/2}}^{1-2} = 0$$

$$J_{FeO}^{Alm} + J_{FeO}^{Lab} + J_{FeO}^{Prg} + v_{FeO}^{1-2} = 0$$

$$J_{MgO}^{Alm} + J_{MgO}^{Lab} + J_{MgO}^{Prg} + v_{MgO}^{1-2} = 0$$

$$J_{CaO}^{Alm} + J_{CaO}^{Lab} + J_{CaO}^{Prg} + v_{CaO}^{1-2} = 0$$

$$J_{NaO_{1/2}}^{Alm} + J_{NaO_{1/2}}^{Lab} + J_{NaO_{1/2}}^{Prg} + v_{NaO_{1/2}}^{1-2} = 0$$

$$J_{SiO_2}^{Lab} + J_{SiO_2}^{Prg} + J_{SiO_2}^{Hyp} + J_{SiO_2}^{Olg} + J_{SiO_2}^{Hbl} + v_{SiO_2}^{2-3} = 0$$

$$J_{AlO_{3/2}}^{Lab} + J_{AlO_{3/2}}^{Prg} + J_{AlO_{3/2}}^{Hyp} + J_{AlO_{3/2}}^{Olg} + J_{AlO_{3/2}}^{Hbl} + v_{AlO_{3/2}}^{2-3} = 0$$

$$J_{FeO}^{Lab} + J_{FeO}^{Prg} + J_{FeO}^{Hyp} + J_{FeO}^{Olg} + J_{FeO}^{Hbl} + J_{FeO}^{2-3} = 0$$

$$J_{MgO}^{Lab} + J_{MgO}^{Prg} + J_{MgO}^{Hyp} + J_{MgO}^{Olg} + J_{MgO}^{Hbl} + v_{MgO}^{2-3} = 0$$

$$J_{CaO}^{Lab} + J_{CaO}^{Prg} + J_{CaO}^{Hyp} + J_{CaO}^{Olg} + J_{CaO}^{Hbl} + v_{CaO}^{2-3} = 0$$

$$J_{NaO_{1/2}}^{Lab} + J_{NaO_{1/2}}^{Prg} + J_{NaO_{1/2}}^{Hyp} + J_{NaO_{1/2}}^{Olg} + J_{NaO_{1/2}}^{Hbl} + v_{NaO_{1/2}}^{2-3} = 0$$

$$J_{SiO_2}^{Hyp} + J_{SiO_2}^{Olg} + J_{SiO_2}^{Hbl} + J_{SiO_2}^{Omp} + v_{SiO_2}^{3-4} = 0$$

$$J_{AlO_{3/2}}^{Hyp} + J_{AlO_{3/2}}^{Olg} + J_{AlO_{3/2}}^{Hbl} + J_{AlO_{3/2}}^{Omp} + v_{AlO_{3/2}}^{3-4} = 0$$

$$J_{FeO}^{Hyp} + J_{FeO}^{Olg} + J_{FeO}^{Hbl} + J_{FeO}^{Omp} + v_{FeO}^{3-4} = 0$$

$$J_{MgO}^{Hyp} + J_{MgO}^{Olg} + J_{MgO}^{Hbl} + J_{MgO}^{Omp} + v_{MgO}^{3-4} = 0$$

$$J_{CaO}^{Hyp} + J_{CaO}^{Olg} + J_{CaO}^{Hbl} + J_{CaO}^{Omp} + v_{CaO}^{3-4} = 0$$

$$J_{NaO_{1/2}}^{Hyp} + J_{NaO_{1/2}}^{Olg} + J_{NaO_{1/2}}^{Hbl} + J_{NaO_{1/2}}^{Omp} + v_{NaO_{1/2}}^{3-4} = 0$$

Flux-Ratio Equations

$$2.40\, J_{SiO_2}^{Lab} + 1.60\, J_{AlO_{3/2}}^{Lab}\left(\frac{L_{Si}}{L_{Al}}\right) + 0.00\, J_{FeO}^{Lab}\left(\frac{L_{Si}}{L_{Fe}}\right) + 0.00\, J_{MgO}^{Lab}\left(\frac{L_{Si}}{L_{Mg}}\right)$$

$$+ 0.60\, J_{CaO}^{Lab}\left(\frac{L_{Si}}{L_{Ca}}\right) + 0.40\, J_{NaO_{1/2}}^{Lab}\left(\frac{L_{Si}}{L_{Na}}\right) = 0$$

$$6.08\, J_{SiO_2}^{Prg} + 2.50\, J_{AlO_{3/2}}^{Prg}\left(\frac{L_{Si}}{L_{Al}}\right) + 1.66\, J_{FeO}^{Prg}\left(\frac{L_{Si}}{L_{Fe}}\right) + 2.64\, J_{MgO}^{Prg}\left(\frac{L_{Si}}{L_{Mg}}\right)$$

$$+ 1.79\, J_{CaO}^{Prg}\left(\frac{L_{Si}}{L_{Ca}}\right) + 0.83\, J_{NaO_{1/2}}^{Prg}\left(\frac{L_{Si}}{L_{Na}}\right) = 0$$

$$1.99\, J_{SiO_2}^{Hyp} + 0.02\, J_{AlO_{3/2}}^{Hyp}\left(\frac{L_{Si}}{L_{Al}}\right) + 0.78\, J_{FeO}^{Hyp}\left(\frac{L_{Si}}{L_{Fe}}\right) + 1.19\, J_{MgO}^{Hyp}\left(\frac{L_{Si}}{L_{Mg}}\right)$$

$$+ 0.02\, J_{CaO}^{Hyp}\left(\frac{L_{Si}}{L_{Ca}}\right) + 0.00\, J_{NaO_{1/2}}^{Hyp}\left(\frac{L_{Si}}{L_{Na}}\right) = 0$$

$$2.77\, J_{SiO_2}^{Olg} + 1.23\, J_{AlO_{3/2}}^{Olg}\left(\frac{L_{Si}}{L_{Al}}\right) + 0.00\, J_{FeO}^{Olg}\left(\frac{L_{Si}}{L_{Fe}}\right) + 0.00\, J_{MgO}^{Olg}\left(\frac{L_{Si}}{L_{Mg}}\right)$$

$$+ 0.23\, J_{CaO}^{Olg}\left(\frac{L_{Si}}{L_{Ca}}\right) + 0.77\, J_{NaO_{1/2}}^{Olg}\left(\frac{L_{Si}}{L_{Na}}\right) = 0$$

$$6.69\, J_{SiO_2}^{Hbl} + 1.59\, J_{AlO_{3/2}}^{Hbl}\left(\frac{L_{Si}}{L_{Al}}\right) + 1.48\, J_{FeO}^{Hbl}\left(\frac{L_{Si}}{L_{Fe}}\right) + 3.02\, J_{MgO}^{Hbl}\left(\frac{L_{Si}}{L_{Mg}}\right)$$

$$+ 1.81\, J_{CaO}^{Hbl}\left(\frac{L_{Si}}{L_{Ca}}\right) + 0.63\, J_{NaO_{1/2}}^{Hbl}\left(\frac{L_{Si}}{L_{Na}}\right) = 0$$

Boundary-Flux Equations

$$J_{SiO_2}^{Alm} = 0 \qquad\qquad J_{SiO_2}^{Omp} = 0.57$$

$$J_{Al_2O_3}^{Alm} = 0 \qquad\qquad J_{Al_2O_3}^{Omp} = -0.29$$

$$J_{FeO}^{Alm} = 0 \qquad\qquad J_{FeO}^{Omp} = 1.53$$

$$J_{MgO}^{Alm} = 0 \qquad\qquad J_{MgO}^{Omp} = 1.02$$

$$J_{CaO}^{Alm} = 0 \qquad\qquad J_{CaO}^{Omp} = 0.69$$

$$J_{Na_2O}^{Alm} = 0 \qquad\qquad J_{Na_2O}^{Omp} = -0.40$$

Extent- of-Reaction Equation

$$v_{Alm}^{1-2} = 1$$