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The System Fe-Mg-Ti-Cr-Si-O: Oxide-Silicate Relationships at High Pressure and Temperature Conditions as a Function of fO2 and Bulk Composition

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Several sets of experiments were performed in multi-component systems to investigate oxide-silicate relationships as a function of pressure, temperature and fO2-conditions Experiments were conducted in in piston cylinder and multi-anvil apparatus in the range 1000-1400°C and 2.5-7 GPa. Most of the experiments were conducted in graphite-platinum double capsules. In order to explore the influence of fO2, an additional set of experiment was performed at a pressure of 2.5 GPa employing double Pt-Mo and Pt-Au/Pd capsules.

The common assemblage present in the runs is composed of olivine-opx-spinel-ilmenite/rutile; garnet is only observed in high-pressure runs exceeding 3.5 GPa Phase parageneses are predominantly controlled by the Fe/Mg ratio and the bulk composition of the system. The Fe-Mg distribution between oxides and silicates displays negative temperature correlation, which is more evident for spinel-oxide pairs whereas the Fe-Mg distribution between ilmenite and silicates is more complex. Taking into account the ferric iron contents of picro-ilmenites (calculated on the basis of charge balance) some pressure effect is evident that, however, does not considerably change the general behaviour.

Compositional variations of oxides are correlating with temperature: depletion in trivalent cations is observed with increasing temperature for spinel, whereas the compositions of ilmenite exhibit enrichment in trivalent cations with increasing temperature.

Under the examined fO2-conditions, the compositions of oxide phases are insensitive to changes in fO2; identical phase assemblages with only negligible compositional variations are observed. Employing Mo-containers additionally resulted in Mo contamination of the oxide phases (spi, ru).

At present, we the obtained experimental data set is utilized to constrain thermodynamic properties of coexisting oxide phases. In particular, we are investigating the solid-solution behavior of Ti- and Cr-bearing spinels and Cr-bearing ilmenites.