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Experimental Investigation of Oxide Silicate Relations in the System Fe-Mg-Ti-Si-Cr-O as a Function of P-T and Bulk Composition

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We have experimentally investigated the influence of Cr^{3+} on the silicate and oxide phase relation (ol + opx + ilm + spi) in the system Mg-Fe-Ti-Si-Cr-O. Two sets of experiments with different Mg/Fe ratio were conducted at pressure of 2.5-3.5 GPa and temperatures in the range 1000-1400˚C. Experiments were performed under relatively reducing conditions by employing graphite containers sealed into Pt-capsule. Some additional experiments were done in an Al-bearing system.

Phase parageneses are strongly controlled by the Fe/Mg ratio of the system: Whereas ilmenite is stable at 2.5 GPa together with olivine + opx + spinel at a bulk X_{Mg} of less than 0.8, rutile + olivine + opx + spinel are coexisting phases at a bulk X_{Mg} of 0.85 in the same pressure range. Shifting the bulk composition at an X_{Mg} of 0.85 towards a more Si-poor composition results in the disappearance of opx and the stabilization of ilmenite. Negative correlations between Cr and Ti contents are observed for coexisting spinel and ilmenite. Enrichment of chromium contents of ilmenite is correlated with depletion of chromium in spinel. The highest Cr_2O_3 content for ilmenite was observed with an X_{Mg}=0.73 at the highest temperature and pressure investigated, while opposite effects were found for spinel. Increasing bulk X_{Mg} considerably reduces the solubility of Cr_2O_3in the oxide phases. Added Al_2O_3 mainly concentrated in spinel and affects the stability of ilmenite and rutile.

Partitioning of Fe and Mg between coexisting oxide and silicate phases shows slightly negative temperature effects. Taking ferric iron contents of picro-ilmenites (calculated on the basis of charge balance) into account, we observe clear pressure effects on the Fe-Mg distribution, which is not evident by considering only the total amount of Fe.