PARTITIONING OF FERRIC AND FERROUS IRON IN PLAGIOCLASE

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Partition coefficients for Fe2O3 and FeO between plagioclase and liquid were estimated using the thermodynamic algorithm of Sugawara (CMP 141, 2001, p. 659-686) on 472 published experiments of tholeiite, FeTi-tholeiite, calc-alkaline, and alkaline magmas. The estimated partition coefficients range from 0.13 to 1.04 for Fe2O3 and from 0.008 to 0.05 for FeO. The partition coefficient of Fe2O3 is on average fifteen to twenty times greater than that of FeO.

Partitioning of Fe2O3 and FeO is independent of both oxygen fugacity and plagioclase composition, contradicting the common assumption that partitioning of Fe2O3 correlates positively with the amount of aluminium in plagioclase. In contrast, SiO2 of the magma correlates positively with the partition coefficients of Fe2O3 and FeO while FeOT of the magma correlates inversely with the partition coefficient of Fe2O3. This is considered to reflect increasing activity of iron in polymerised SiO2-rich and FeOT-poor magma.

Advances of micro beam Fe-XANES (X-ray Absorption Near-Edge Structure) techniques allow the determination of Fe3+/FeT in plagioclase. Using such plagioclase data and the partition coefficients for Fe2O3 and FeO, the Fe2O3/FeO and oxygen fugacity of equilibrium magma may be estimated. As petrological examples, we have calculated the oxygen fugacity of the Palisades Sill to the QFM buffer and Upper Zone a of the Skaergaard intrusion to 1.5 log units below the QFM. The petrological application of iron in plagioclase as a monitor of oxygen fugacity in layered intrusions is presented by Tegner et al. (this meeting).