Partitioning of Cu between mafic minerals, magnetite and intermediate-felsic melts

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Cu is an important ore-forming element. Modelling the enrichment or depletion of Cu in a magma depends on accurate Cu partition coefficients between mafic minerals, magnetite and intermediate-felsic melts if sulfide is absent (e.g. at high oxygen fugacity conditions). We determined Cu partition coefficients ($D_{Cu}^{mineral/melt}$) between olivine, opx, cpx, garnet, amphibole, magnetite and intermediate-felsic melts, using $Pt_{95}Cu_{05}$ alloy capsules as Cu source, which avoid the problem of Cu loss into noble metal capsules. The experiments were conducted in piston-cylinder presses with mafic –felsic starting compositions at 0.5–2.5 GPa, 850–1100°C and oxygen fugacity ranging from FMQ-1 to FMQ+5.

The results show that Cu is incompatible in all the studied silicate minerals, with partition coefficients ranging from 0.11 to 0.20 for olivine, 0.12-0.24 for orthopyroxene, 0.02-0.45 for clinopyroxene, 0.01-0.06 for garnet, and 0.04-0.13 for amphibole. Cu is moderately incompatible to slightly compatible in (Ti-bearing) magnetite, with partition coefficient ranging from 0.17-1.67. Generally, measured D_{Cu} values for each mineral are higher in felsic melts compared to in intermediate melts, which is consistent with the lower Cu solubility in more felsic melts. The $D_{Cu}^{cpx/melt}$ increases with increasing Na_2O content in cpx, and the $D_{Cu}^{magnetite/melt}$ increases with increasing Fe^{3+} in magnetite.