

Arsenic, Te and Se solubility in basaltic melts: the role of metal ligands

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A large proportion of platinum-group elements (PGE) in magmatic sulfide ores occur as discrete minerals, mostly in the form of PGE arsenides, tellurides, bismuthotellurides, stannides, and some (Ru, Pt) as sulfides. Given that most some of these phases may be magmatic in origin, it is important to quantify the solubilities of most important anionic ligands with which the PGE may form discrete phases. To determine the solubility of As, Te, and Se in basaltic melts and to see if their solubilities depend on the metal ligand spectrum present, piston cylinder experiments are performed at 1250 and 1350°C with basaltic melt coexisting with immiscible Fe, Pt, and Pd arsenide, selenide and telluride melts. The highest solubilities of chalcogen and semimetal species are recorded when As, Se, and Te are added in the form of FeAs, FeSe, and FeTe melts, that is, when the ferrous iron cation is the principal metal ligand. When instead Pt or Pd arsenides, selenides or tellurides are used as As, Se, and Te reservoirs, the solubilities fall drastically, e.g. for PtTe and PdTe by a factor of up to 20 compared with experiments carried out with FeTe melt. The influence of metal speciation on As solubility is small. At the relative fO_2 of the experiments (\sim FMQ to FMQ+1) appreciable As may be present as cationic species, and may therefore not be available as ligand to transition metal cations.