

# ***Experimental determinations of trace element partitioning between sulfide and silicate melts at low oxygen fugacities***

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To understand the trace element distribution between sulfide and silicate melt at conditions relevant for reduced silicate mantles, twenty-nine experiments were conducted to measure the partition coefficients ( $D$ ) of Ti, V, Cr, Mn, Co, Ni, Cu, Zn, As, Sn, Sb, Nb, Ta, Zr, Hf, Ag, Mo, W, Au, and Pb between sulfide and silicate melts. The experiments were conducted in graphite or graphite-lined Pt<sub>95</sub>Rh<sub>05</sub> capsules at 1.5–7 GPa, 1700–2200 °C, and oxygen fugacities 1–7 log units below the iron-wüstite buffer, using piston cylinder and multi-anvil apparatuses. The results show that the S content of the silicate melt at sulfide-saturation (SCSS) decreases from 0.33 to 0.18 wt.% with decreasing the FeO content of the silicate melt (denoted [FeO]<sub>melt</sub>) from 21 to 4 wt.%, but then increases to 6.5 wt.% at [FeO]<sub>melt</sub> < 1 wt.%. The values of nominally lithophile elements Ti, V, Mn, Cr, Zn, Nb, and Ta increase from <0.01 to >1000 with decreasing [FeO]<sub>melt</sub> to <1 wt.%, but Zr and Hf remain incompatible in the sulfide melt. The values of nominally chalcophile elements S, Ni, Cu, Ag, and Au first increase with decreasing [FeO]<sub>melt</sub>, but then drop by a few orders of magnitude at <1 wt.% [FeO]<sub>melt</sub>. The values of nominally moderately siderophile elements W, Mo, As, Sn, Sb, and Co increase up to 10<sup>5</sup> with decreasing [FeO]<sub>melt</sub> from ~20 to 0.2 wt.%. The S concentration in the silicate melt strongly controls trace element partitioning by forming metal-sulfide species, by replacing O<sup>2-</sup>, or by changing the activity coefficients of trace elements in the silicate melt. Our results show that oxygen fugacity can significantly affect the partitioning behavior of trace elements between sulfide and silicate melt, and the fate of trace elements during magmatic processes of reduced silicate mantles could be different from that in relatively oxidized terrestrial mantle.