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Trace elements in magmatic sulphide droplets from island arcs, back-arc basins and mid-ocean ridges

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Magmatic sulphide droplets and silicate melt-sulphide liquid partition coefficients are useful for understanding the chalcophile element cycle in the Earth's crust [1-2]. We present in-situ LA-ICP-MS data on the trace element composition of bulk magmatic sulphide droplets and glasses hosted by submarine volcanic rocks of basaltic to rhyolitic rock composition from island arc, back-arc and mid-ocean ridge settings. The sulphide droplets are mainly associated with olivine in mid-ocean ridge basalts and with Fe-Ti oxides in more evolved island arc rocks. This suggests that reduced magmas experience an early-stage sulphide saturation and more oxidised subduction zone-related magmas segregate sulphide liquids in a later stage following redox changes induced by Fe-Ti oxide fractionation [3]. Nickel is typically enriched in the sulphide droplets from reduced mid-ocean ridge magmas compared to those from subduction zone-related melts, which we refer to the competitive incorporation of Ni into olivine [2]. Surprisingly, most other chalcophile trace elements display an overall large variation but seem to lack a systematic relation to the timing of sulphide saturation between different plate-tectonic settings. However, the partition coefficients of some elements show an increase with fractionation until 60 wt.% SiO_2 is reached and drops again afterwards. How this relates to the chalcophile element composition of the mantle-derived primary melts between plate-tectonic settings remains elusive [4]. Our preliminary results raise the question, whether it is still valid to conclude that the composition of the rocks hosting a hydrothermal system directly influences the metal endowment of seafloor massive sulphides [5].

[1] Patten, C. et al. (2013), *Chemical Geology*, 358, 170–188. [2] Keith, M. et al. (2017), *Chemical Geology*, 451, 67–77. [3] Jenner, F. E. et al. (2010), *Journal of Petrology*, 51, 2445-2464. [4] Lee, C. A. et al. (2012), *Science*, 336, 64-68. [5] Hannington, M. D. et al. (2005), *Economic Geology*, 100, 111-141.