



## **Chalcophile element partitioning into magmatic sulphides: the effect of silicate melt composition**

Kate Kiseeva and Bernard Wood

University of Oxford, United Kingdom (kate.kiseeva@earth.ox.ac.uk)

Partitioning of many elements between sulphide and silicate melts is a function of the FeO content of the silicate liquid (Kiseeva and Wood, 2013). The theoretical relationship is a linear one between  $\text{LogDM}$  ( $\text{DM} = [\text{M}]_{\text{sulph}}/[\text{M}]_{\text{sil}}$ ) and  $-\log[\text{FeO}]$  with a slope of  $n/2$ , where  $n$  is the valency of trace element  $M$ . In practice we find that the slope deviates from the theoretical one because of the presence of oxygen in the sulphide.

In our recent study we investigated the effects of sulphide composition and temperature on chalcophile element partitioning between sulphide and silicate liquids (Kiseeva and Wood, 2015). We have concluded that partitioning of most chalcophile elements is a strong function of the oxygen (or FeO) content of the sulphide. As expected, lithophile elements partition more strongly into sulphide as its oxygen content increases, while chalcophile elements enter sulphide less readily with increasing oxygen. The effect of Ni and Cu content of sulphide is significantly smaller than the effect of oxygen, while the effects of temperature are large only for a number of elements (such as Ni, Cu, Ag).

In this study we show that in addition to the effect of sulphide composition, for certain elements the effect of silicate melt composition on sulphide/silicate partitioning can be quite large. For instance, within the range of NBO/T between 0.5 and 2 the  $D_{\text{T}}[\text{sulph}/\text{sil}]$  changes in order of magnitude. For the elements, like Pb, partition coefficient does not seem to change much with the silicate melt composition, while for Sb the effect of the silicate melt composition on  $D$  is a factor of 3.

Partitioning of chalcophile elements into more evolved, alkali-rich and felsic magmas is estimated to be very different from the partitioning into basaltic melts, mainly due to the strong effects of temperature and alkali components. Although it is highly likely that sulphide is in solid form at liquidus temperatures for dacite and rhyolite and thus the partitioning of chalcophile elements is governed by solid sulphide-liquid silicate relationship, if assuming the presence of two liquids,  $D_{\text{sulph}/\text{sil}}$  for Cu is approximately 2 times higher for dacite and 6 times higher for rhyolite than for basaltic liquids. This means that the combined effects of temperature and silicate melt composition, which are intimately linked in nature, have a profound effect on the sulphide-silicate partitioning and on the composition of precipitated sulphide.

Kiseeva E.S., Wood B. J. (2013). *EPSL* 383, p. 68-81.

Kiseeva E.S., Wood B. J. (2015). *EPSL* 424, p. 280-294.