V038-0014 - Identifying lithological tracers with first row transition element partitioning in natural pyroxenites

Mantle heterogeneity has a first-order control on the petrological and geochemical differences of erupted mafic lavas across the globe. It is debated whether this heterogeneity reflects only chemical variability or also lithological differences in source regions. Because of their various partitioning behaviors between mantle minerals, First Row Transition Elements (FRTEs) have been identified as potential lithological tracers. Here, we investigate the various parameters that control FRTE partitioning between common mantle phases through a comparison of partition coefficients calculated from natural pyroxenites obtained from the Earthchem database with previous partitioning experiments and new electron microprobe analyses. Using naturally occurring pyroxenites from alpine massifs and xenoliths provides the opportunity to explore the behavior of FRTEs on a much larger range of compositions and temperatures than covered by experimental studies. Our preliminary results show that natural partition coefficients for Fe and Mn depend on temperature and vary distinctly between lithologies. The effect of composition, however, is difficult to resolve and will require further inspection. Natural exchange coefficients, or Kd's (mineral/mineral) for Mn/Fe, largely match previous experimental data across peridotite and pyroxenite compositions for garnet/clinopyroxene(cpx), orthopyroxene/cpx, and olivine/cpx. However, natural samples often present evidence of chemical disequilibrium and/or secondary alteration which can significantly increase the scatter in analyses. Importantly, despite the larger uncertainty on the natural Kd's than on experimental ones, natural exchange coefficients show distinct values between the various pairs of minerals. These distinctions, and the fact that Kd's do not seem to be influenced by temperature, make the bulk Mn/Fe ratio in lavas a good lithological tracer, supporting previous claims. Hence, we show that natural compositions can be used to expand trends in FRTE distribution behavior across a wider range of temperatures (500-1500°C) and compositions than determined previously by experiments alone.

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