## Appendix: Analytical Methods

For low precision analysis of olivines in the experimental work of KLB-1, the analytical method was reported in Herzberg and Zhang (1996).

For high precision analysis of natural olivines, major and minor element compositions were obtained from olivines using a modified version of the high precision EPMA protocol of Sobolev et al., 2007. All samples were analyzed with a focused beam (~1 um) at 20 kV and 300 nA. On peak count times for all analyses are as follows: Si: 50s; Mg: 80s; Fe: 100s; Ni: 150s; Ca: 150s; Mn: 200s and Co: 400s. The interference of the Fe Kb peak on Co Ka peak was corrected using a quantitative correction in Probe for EPMA software (Donovan, 2012). In order to correct for instrumental drift the San Carlos olivine standard was analyzed at regular intervals during each run. Each analysis for Siqueiros MORB olivine (Tables A4) and West Greenland-Baffin Island olivine (Table A5) is the average of four separate analyses that were taken within ~25um of each other within olivine cores. Table A6 reports both unaveraged individual analyses and averages for 2 San Carlos olivine grains. Synthetic endmember olivines (Forsterite, Fayalite, Tephroite, $Ni_2SiO_4$ and $Co_2SiO_4$) and Chromian Augite (Jarosewich et al., 1987) were used as the primary standards. Average detection limits ($3\sigma$) of the individual, unaveraged analyses are as follows: Si: 0.0046 wt. %; Mg: 0.0032 wt. %; Fe: 0.0027 wt. %; Ni: 0.0024 wt. %; Ca: 0.0017 wt. %; Mn: 0.0021 wt. % and Co: 0.0014 wt. %. Average percent errors ($1\sigma$) of the individual, unaveraged analyses are as follows: Si: 0.0653; Mg: 0.0539; Fe: 0.0986; Ni: 0.5866; Ca: 0.527; Mn: 1.0036 and Co: 4.7264. All of the above counting statistics were calculated by the Probe for EPMA software (Donovan, 2012).

## References

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