Supporting Information for

Compositional variability of San Carlos olivine

S. Lambart[1], S. Hamilton[1], and O. Lang[1,2]

[1]Department of Geology and Geophysics, University of Utah.

[2]Department of Geography, University of Utah.

Contents of this file: Figures S1 to S6 and references cited in Supplementary Figures and Supplementary Tables

Additional Supporting Information (Files uploaded separately): Tables S1 to S5

Supplementary Figures.

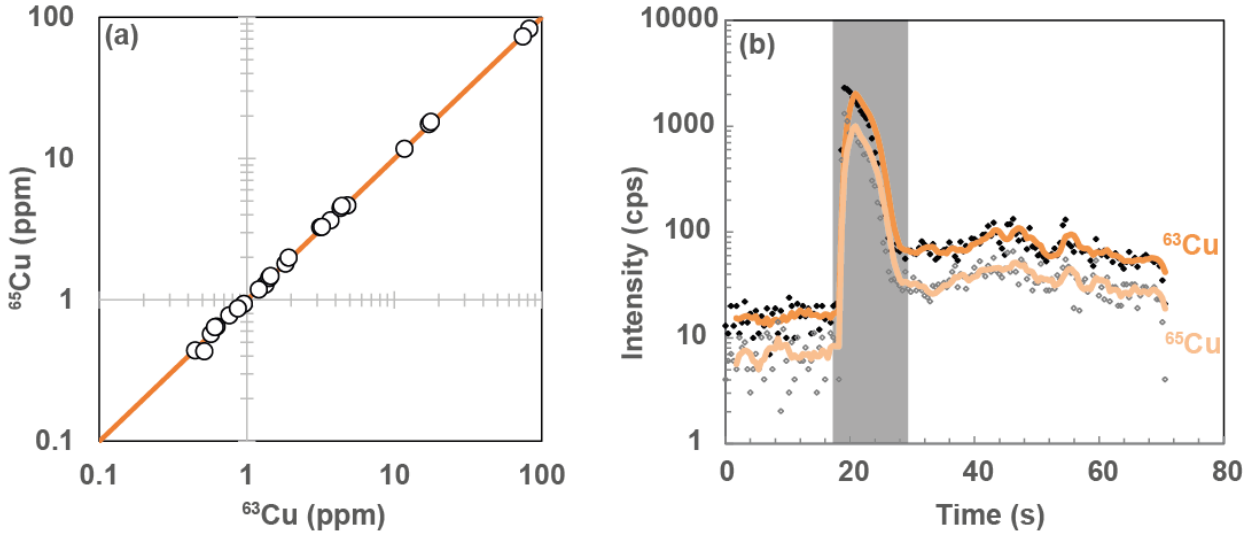

Figure S1. (a) Comparison between the average concentration in copper before correction obtained for olivine analyses performed on xenoliths using ^{63}Cu and ^{65}Cu. (b) Example of signal obtained for ^{63}Cu and ^{65}Cu showing a peak of intensity at the beginning of the line (sample: SC3-2). The shaded area shows the discarded part of the signal to correct for the presence of the inclusion. Note the log-scale on the intensity axis.

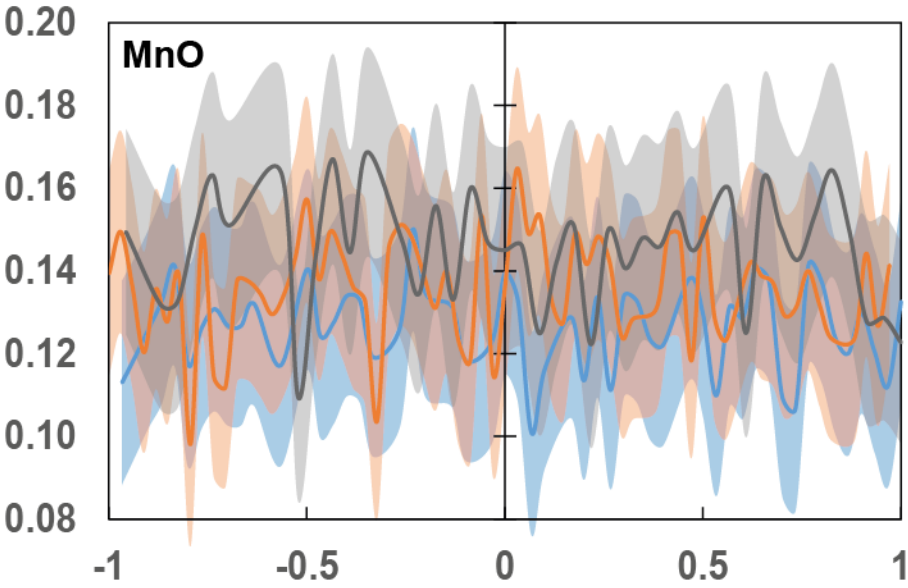

Figure S2. MnO (wt. %) profiles in three large San Carlos grain (non-USNM distributed) using the one-step setup. Distance is normalized to compare the three grains. Spatial resolution is 100µm. The shaded area around each profile represents ± 2AE.

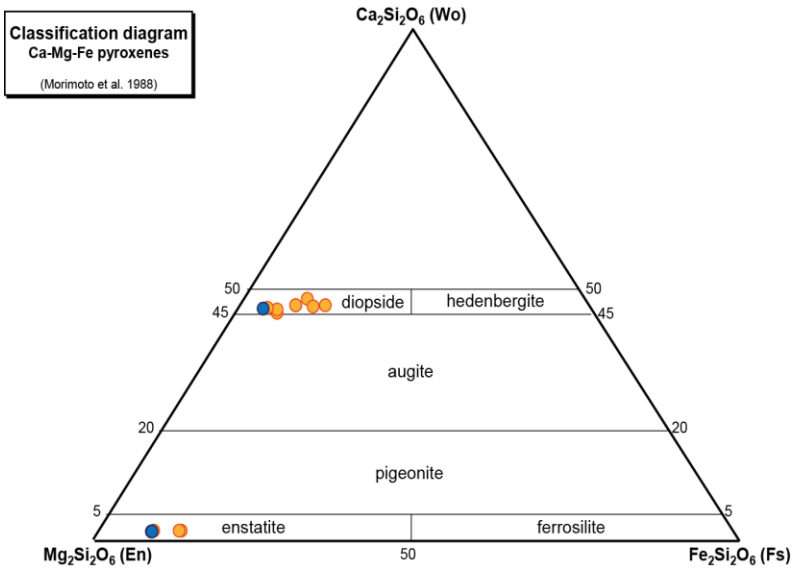

Figure S3. Compositions of the clinopyroxenes analyzed in this study (yellow: pyroxenite; blue: peridotite). Diagram was built with PX-NOM (Sturm, 2002).

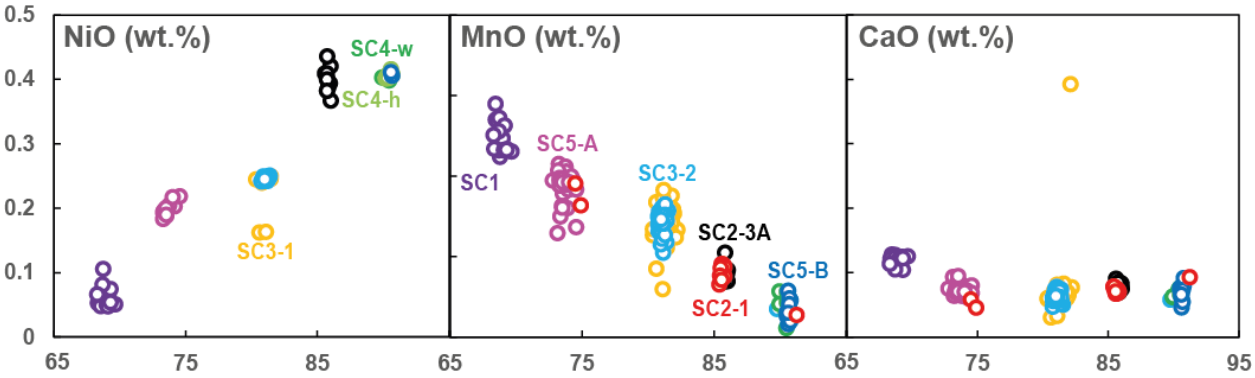

Figure S4. Minor elements concentrations in the olivines from the xenoliths. Both 1-step and two-step analyses are represented.

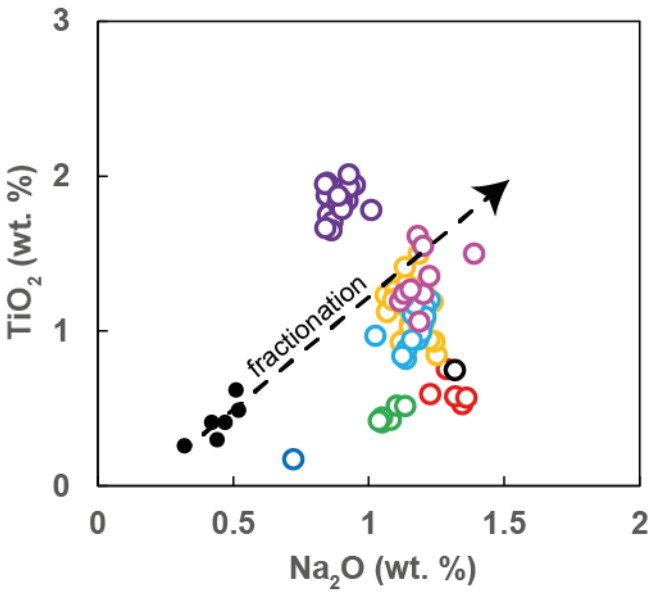

Figure S5. TiO_2 vs Na_2O in clinopyroxene analyzed in this study (open circles) compared with the extrapolation trend obtained from the clinopyroxenes (black circles) along the liquid line of descent of a tholeiitic basalt during equilibrium crystallization at 1 GPa (Villiger et al., 2004). The color code is the same than in Figure S3.

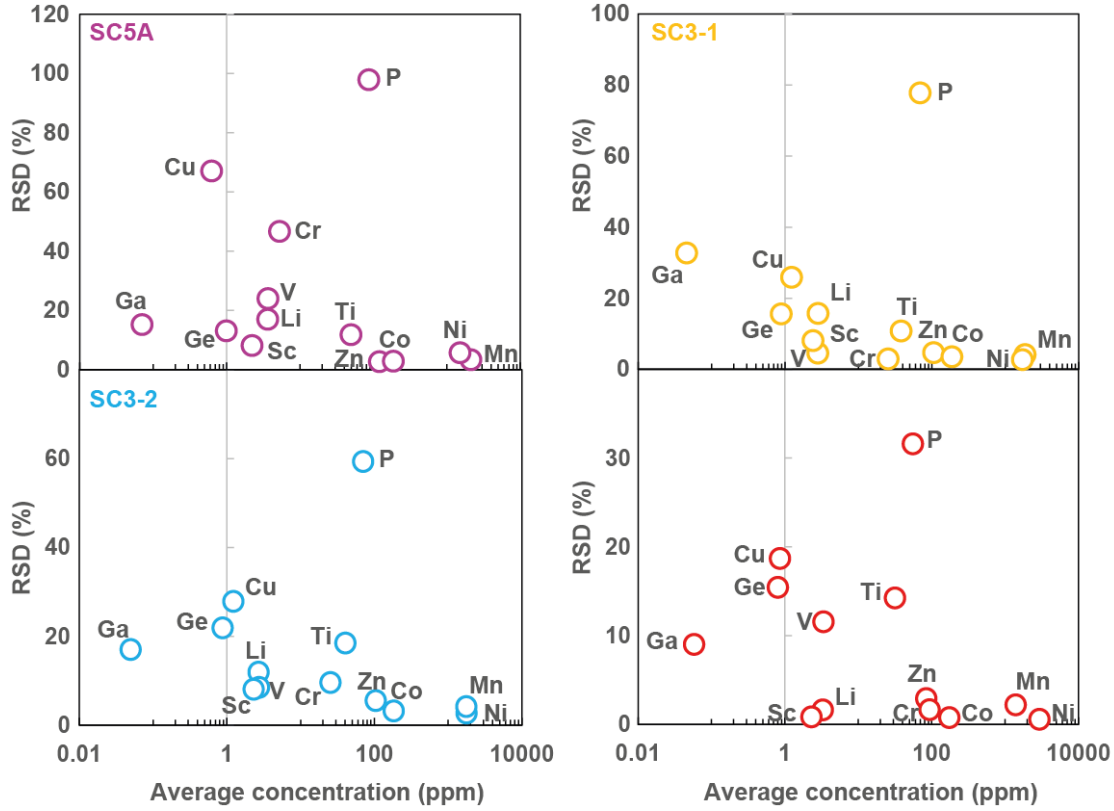

Figure S6. Relative variability (RSD=2SD/Average concentration) of the trace and minor element concentrations in the olivine for the xenoliths SC5-A, SC3-1, SC3-2 and SC2-1.

Supplementary references:

Batanova, V. G., Sobolev, A. V., & Kuzmin, D. V. (2015). Trace element analysis of olivine: High precision analytical method for JEOL JXA-8230 electron probe microanalyser. Chemical Geology, 419, 149-157.

Batanova, V. G., Thompson, J. M., Danyushevsky, L. V., Portnyagin, M. V., Garbe-Schönberg, D., Hauri, E., ... & Sobolev, A. V. (2019). New olivine reference material for in situ microanalysis. Geostandards and Geoanalytical Research, 43(3), 453-473.

Couperthwaite, F. K., Thordarson, T., Morgan, D. J., Harvey, J., & Wilson, M. (2020). Diffusion timescales of magmatic processes in the Moinui lava eruption at Mauna Loa, Hawaii, as inferred from bimodal olivine populations. Journal of Petrology, 61(7), egaa058.

De Hoog, J. C., Gall, L., & Cornell, D. H. (2010). Trace-element geochemistry of mantle olivine and application to mantle petrogenesis and geothermobarometry. Chemical Geology, 270(1-4), 196-215.

Gao, S., Liu, X., Yuan, H., Hattendorf, B., Günther, D., Chen, L., & Hu, S. (2002). Determination of forty two major and trace elements in USGS and NIST SRM glasses by laser ablation-inductively coupled plasma-mass spectrometry. Geostandards Newsletter, 26(2), 181-196.

Gordeychik, B., Churikova, T., Kronz, A., Sundermeyer, C., Simakin, A., & Wörner, G. (2018). Growth of, and diffusion in, olivine in ultra-fast ascending basalt magmas from Shiveluch volcano. Scientific reports, 8(1), 1-15.

Li, X., Zeng, Z., Dan, W., Yang, H., Wang, X., Fang, B., & Li, Q. (2020). Source lithology and crustal assimilation recorded in low δ18O olivine from Okinawa Trough, back-arc basin. Lithos, 360, 105444.

Lynn, K. J., Garcia, M. O., & Shea, T. (2020). Phosphorus coupling obfuscates lithium geospeedometry in olivine. Frontiers in Earth Science, 8, 135.

Stead, C. V., Tomlinson, E. L., Kamber, B. S., Babechuk, M. G., & McKenna, C. A. (2017). Rare earth element determination in olivine by laser ablation-quadrupole-ICP-MS: An analytical strategy and applications. Geostandards and Geoanalytical Research, 41(2), 197-212.

Sturm, R. (2002). PX-NOM—an interactive spreadsheet program for the computation of pyroxene analyses derived from the electron microprobe. Computers & Geosciences, 28(4), 473-483.

USGS (2002) Geochemical Reference Materials and Certificates.
http://minerals.cr.usgs.gov/geo_chem_stand/

Villiger, S., Ulmer, P., Müntener, O., & Thompson, A. B. (2004). The liquid line of descent of anhydrous, mantle-derived, tholeiitic liquids by fractional and equilibrium crystallization—an experimental study at 1· 0 GPa. Journal of Petrology, 45(12), 2369-2388.