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CHEMICAL VARIABILITY AND CHARACTERIZATION OF SAN CARLOS OLIVINE AS STARTING MATERIAL IN EXPERIMENTAL PETROLOGY

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The San Carlos volcanic field is one of the many late Tertiary to Quaternary centers of alkaline volcanism within the Basin and Range that bear ultramafic xenoliths. Ultramafic xenoliths, as direct samples of the lithospheric mantle, may help to elucidate thermal and mechanical coupling between the crust and the mantle. Additionally, natural forsterite (Fo)-rich olivines are commonly used in scientific research. Many electron microprobe labs use the San Carlos standard USNM 111312/444 (1) for calibrations. However, non-USNM-distributed crystals of San Carlos olivine are also available commercially and often used as starting material in experimental studies (e.g., 2, 3). The potential inherent chemical variability of starting materials can affect geochemical results. Additionally, minor and trace elements in olivines are used to interpret various petrogenetic processes (e.g., 4, 5). Hence, it is important to characterize the full chemical variability of the San Carlos olivine. Fournelle (6) showed that the USNM San Carlos standard composition shows only slight variability ($Fo_{89.6}$ to $Fo_{90.5}$), but that non-standard San Carlos olivine can be significantly more variable, with Fo contents ranging from 87 to 92%. Following these results, we report analyses on 12 grains (0.5 mm - >5mm) of non-USNM San Carlos olivine. We also investigate the presence of potential grain-scale chemical variations by looking at composition profiles on the large (> 5mm) grains. Observed major-element variations (e.g., $Fo_{88.2}$ to $Fo_{91.6}$) are consistent with Fournelle's results (6) and we show that minor-element concentrations present significant variations between grains (e.g., 15.1% MnO, 7.2% NiO, 28.6% CaO, relative). At the scale of the individual grain, however, San Carlos olivines appear relatively homogeneous with no systematic core-rim variations. We are currently processing the trace-element analyses. Results and implications for the use of this material in experimental studies and for interpretations of the petrogenetic processes will be discussed.

(1) Jarosewich et al. (1979), Smithsonian contrib. to the earth sciences 22. (2) Kinzler & Grove (1992) JGR: Solid Earth, 97. (3) Wang & Gaetani (2008), CMP 156. (4) Su et al. (2019), Lithos 207-216. (5) Sobolev et al. (2007), Science 316. (6) Fournelle (2011), Microsc. Microanal. 17.