Effects of Farallon slab subduction on the halogen budget of the North American lithosphere

JOHN C LASSITER[1], JAIME D BARNES[1], ALEX HOLMES[1], GEORGE H SEGEE-WRIGHT[1], GRACE M BEAUDOIN[1], ELIS HOFFMANN[2], TIMM JOHN[2]

[1]Dept. Geol. Sci., Jackson School of Geoscience, U. Texas, Austin, TX; lassiter1@jsg.utexas.edu
[2]Inst. Geol. Wiss., F. U. Berlin

Flat subduction of the Farallon slab modified the North American SCLM through introduction of slab-derived components. Halogen concentrations in mantle xenoliths from the Navajo Volcanic Field (NVF), Colorado Plateau, Cerro Chato (CC; eastern Colorado Plateau margin) and Elephant Butte (EB; central Rio Grande Rift) constrain the effects of Farallon-related metasomatism on halogen abundances.

Most xenoliths from CC and EB have low Cl and F abundances (ave. 4.8 and 24 ppm respectively). Average Cl/Nb (~11) and F/Nd (~31) ratios are similar to MORB/OIB and to olivine-hosted melt inclusions from these locations (*Rowe et al*., 2015). No correlations are observed in halogen abundances or ratios with indices of metasomatism or melt depletion (e.g., LREE-enrichment or Cr#). Thus, evidence for significant Cl or F input from Farallon-slab-derived fluids is lacking. In contrast, xenoliths from the NVF have much higher Cl abundances (ave. 205 ppm) but similar F abundances (ave. 14 ppm). Despite their Cl enrichment, the NVF samples do not show any correlation between Cl and other indices of metasomatism.

The heavy halogens (Br and I) are strongly enriched in both the NVF and the CC/EB xenoliths, with I concentrations ranging up to nearly 800 ppb in the CC/EB xenoliths. I/Cl and I/Br ratios are elevated relative to MORB/OIB. These enrichments contrast with low Br and I abundances in southern Rio Grande Rift xenoliths (San Carlos and Kilbourne Hole; *Kobayashi et al*, 2019), but are similar to western Antarctic xenoliths (*Broadley et al*, 2016), and may reflect heavy halogen addition from slab-derived fluids.

The decoupling of halogen abundances from each other and from other proxies for addition of slab melt or fluid (e.g., Ba/Nb, Sr/Nd) suggests that halogens may derive from multiple sources, including subducted sediments and serpentinized peridotite. Detailed examination of regional variations may therefore provide constraints on slab-mantle volatile fluxes along an evolving P-T-t pathway.

Rowe et al., G^3, 2015; Kobayashi, et al., G^3, 2016; Broadley et al., GCA, 2016.