ABSTRACT

TITLE:	Implications of Chemical Signatures in Apatite from Ultrapotassic to Potassic Rocks of the Navajo Volcanic Field
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ABSTRACT: Numerous studies on rocks of the Navajo volcanic field (NVF) have been conducted in the last fifty years, but there are still questions about the origin and evolution of NVF magmas. Electron microprobe and laser ablation ICP-MS analyses on apatite crystals from NVF rocks reveal distinct chemical differences and trends that further support the notion that these rocks were created from several different magma sources. Bulk-rock geochemical trends reveal that all rocks in the NVF are potassic to ultrapotassic (K2O/Na2O from 1 to 5) with SiO2 ranging from 30 to 60 weight percent. All NVF rocks are enriched in large-ion lithophile elements (K, Sr, Rb, Ba) and LREE. Samples with greater than 45 weight percent SiO2 tend to show downward spikes in Nb-Ta and Ti and sharp upward spikes in Pb on some spider diagrams, indicating arc-like signatures. Katungite samples with less than 40 weight percent SiO2; however, share some similarities to ocean-island basalts. Normalized-REE patterns for apatite crystals from katungite samples reveal ~10 times less enriched in LREE compared to the minettes and transitional-rock compositions. On plots of selected rare earth elements versus CaO the apatite crystals from katungites plot in distinctly separate fields compared to the minettes and transitional compositions. A plot of La+Ce against CaO shows that these elements are the lowest in apatite from the katungites, which is also observed in data from olivine crystals.
The mineral-chemical data for minettes and transitional compositions are consistent with magma genesis by partial melting of highly enriched sub-continental lithospheric mantle. The distinct difference in the chemical signatures for the katungites, lend evidence that these rocks were generated from a deeper less-enriched mantle source that interacted with lithospheric mantle to produce the slightly elevated LREE signatures. Our data indicate that the NVF magmas involved several different melt phases during generation, which produced the wide spectrum of chemical trends we observe in these rocks.