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Using radiogenic Nd, Pb, and Sr isotopes to decipher magma sources during the onset of extension of the northern Rio Grande rift

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Extension of the northern portion of the Rio Grande rift likely began between 33-26 Ma [1]. We analyzed volcanic rocks from the eastern side of the rift in order to understand the changing magma source regions during the initiation of extension in central Colorado. Samples include 29 Ma rhyolites near Nathrop and a 36 Ma andesite from Guffey, located ~50 km east of Nathrop. The rhyolite samples have isotopic compositions (e.g., εNd(t) ~ -10) that are more crustal than subcontinental lithospheric mantle (SCLM), whereas the andesite sample from Guffey has isotopic compositions (e.g., εNd(t) ~ -5) consistent with a SCLM source. These volcanic samples on the eastern side of the rift show a temporal connection to the Mt Princeton batholith on the western side of the rift. The Mt. Princeton batholith dominantly consists of quartz monzonites (εNd(t) between -9 and -10) that formed between 35-36 Ma, with later intrusions of leucogranites at ~30 Ma [2]. The Nathrop rhyolites and leucogranites from the Mt. Princeton batholith formed between 31-29 Ma and have similar εNd(t) values and initial Pb isotopic ratios. The Guffey andesite and Mt. Princeton quartz monzonites both formed around 36 Ma, and also have similar initial Pb isotopic ratios. However, the andesite is significantly more primitive in terms of Nd and Sr isotopes.

Given their similarity in age and radiogenic isotopes, the rhyolites and leucogranites likely came from a similar source. In contrast, the isotopic comparisons between the 35-36 Ma quartz monzonites intrusions and the 36 Ma andesite imply that: 1) there may have been different active mantle sources within this time window, and/or 2) the intrusions assimilated more crust than the andesite. However, the Pb isotopic compositions are similar for all the rocks investigated here between 36-29 Ma, spanning the proposed initiation of extension. Combined with published data, Pb isotopic compositions of Cenozoic magmas in Colorado appear to correlate with latitude, suggesting that lateral variations in the SCLM or lower crust likely control the Pb isotopic compositions of Cenozoic magmas of various compositions.

[1] van Wijk et al. (2018) *Geosphere*, 14(2), 684-709

[2] Rosera et al. (in prep)