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New Mexico GEOLOGY

NEW MEXICO BUREAU OF GEOLOGY AND MINERAL RESOURCES

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Petrogenesis of the Railroad Mountain Alkali Olivine Diabase Dike: Intrusion at the Edge of the Stable Craton in Eastern New Mexico

James Constantopoulos

Railroad Mountain is an alkali olivine diabase dike located approximately 60 km northeast of Roswell, New Mexico. The dike was intruded at the edge of the stable North American craton and marks the eastern limit of the Lincoln County porphyry belt. The intrusion is approximately 50 km long and 30–45 m wide, with a maximum height of approximately 25 m. Groundmass $^{40}Ar/^{39}Ar$ ages average 27.66 Ma. The rocks are remarkably fresh, with little evidence of alteration and only a thin bake zone along the margins. Most of the samples from the core of the dike display a diabasic texture, becoming finer-grained and trachytic closer to the margins. The mineralogy is characterized by plagioclase (~60%), Ti-rich augite (~20%), olivine (~10%), and opaques (~10%). Major element oxide concentrations vary by less than 1 wt%, with a mean SiO_2 concentration of 47.51 wt% and an average Mg# of 41.84. The rocks are nepheline normative and plot in a tight cluster on the total alkali-silica diagram. Geochemically, they are sodic alkali trachybasalts. LREEs are moderately enriched, HREE enrichment is minimal, and Eu anomalies are negligible. The REE data suggest an asthenospheric mantle source with no residual garnet. Petrogenetic models were created using spinel lherzolite REE chemistry and Kilbourne Hole mineralogy. The results of nonmodal equilibrium and nonmodal fractional batch melting models were similar, indicating approximately 5% partial melting of metasomatized mantle. Intrusion occurred during the foundering and tearing of the Farallon slab and coincided with the initiation of Rio Grande rifting.

View looking west along the top of Railroad Mountain, an olivine diabase dike in Chaves County, New Mexico. Railroad Mountain forms a resistant ridge with up to 25 m of relief and is the easternmost intrusive body of the Lincoln County porphyry belt. The dike is dated at 27.66 Ma and was intruded at the edge of the stable North American craton at the beginning of Rio Grande rifting. *Photo by James Constantopoulos*

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