Rare Earth Elements (REE) Potential in the Cornudas Mountains, Southern New Mexico

Virginia T. McLemore, Nels Iverson, Mason Woodard, Haley Dietz, Ethan Haft, Snir Attia, Richard Kelley
New Mexico Bureau of Geology and Mineral Resources, New Mexico Institute of Mining and Technology, Socorro, NM, USA

Re-examination of the rare earth elements (REE) deposits in the Cornudas Mountains is warranted in light of today's economic importance of critical minerals, including REE that are essential in most of our electronic devices. New mapping and petrographic, $^{40}Ar/^{39}Ar$ geochronology, and geochemical analyses are underway. The Cornudas Mountains form the northern Trans–Pecos alkaline magmatic province in the southern part of the North American Cordilleran alkaline-igneous belt. The igneous rocks in the area were emplaced ~36-25 Ma, just prior to or during the early phases of Rio Grande rift extension, and consist of 1) larger nepheline syenite–syenite laccoliths and plugs, 2) phonolite plugs, sills, and dikes, and 3) smaller syenite plugs and dikes that intrude Permian and Cretaceous sedimentary rocks. New USGS geophysical data indicate that some of these intrusions extend deep into the subsurface, with additional intrusions potentially buried in the subsurface. The focus of REE exploration is along the outer edge of the Wind Mountain nepheline syenite laccolith, as well as within syenite–phonolite dikes, plugs and altered areas in Chess Draw. Some samples contain as much as 3110 ppm total REE, hosted in REE-bearing minerals (eudialyte, monazite, bastnäsite, calciocatapleiite). We incorporate whole rock and clinopyroxene chemistry of each intrusion into the clinopyroxene-liquid geothermobarometer (Putirka, 2008) to determine the temperatures and pressures of emplacement. This thermometer provides higher crystallization temperature estimates for the syenite intrusions (821-1019^{o}C) than the phonolite sills (763-797^{o}C). We then use the barometric estimates (1.4-2.9 kbar) to calculate emplacement depths (5.2-10.8 km). Pairing these depths with the new geochronology, we can estimate minimum exhumation rates for intrusions in the Cornudas Mountains that range from 0.1-0.4 mm/yr, with faster exhumation rates for younger intrusions. Estimating crystallization temperatures and exhumation rates provide additional information to aid in developing a model for the formation of REE deposits.