Mineral deposits associated with Tertiary alkaline igneous rocks in New Mexico

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Waldemar Lindgren was one of the first geologists who noted that a belt of alkaline-igneous rocks extends from Alaska and British Columbia southward into New Mexico, Trans-Pecos Texas, and eastern Mexico and that these rocks contain relatively large quantities of gold, fluorine, zirconium, rare earth elements (REE), and other elements. Since then, the North American Cordilleran alkaline-igneous belt has been explored and exploited for numerous types of mineral deposits, especially gold. In New Mexico, the belt extends from the Sangre de Cristo Mountains near Raton, southward to the Cornudas Mountains, in the northern Trans-Pecos alkaline belt. Significant mineral production in New Mexico, especially gold, has come from deposits found within this belt. The New Mexico deposits have been referred to as Great Plains Margin deposits, Au-Ag-Te veins, Th-REE veins, alkaline-igneous related gold deposits, porphyry gold deposits, and Rocky Mountain gold province. Mid-Tertiary alkaline to subalkaline igneous rocks are found associated with mineral deposits in these districts and, in New Mexico, consist of seven deposit types: (1) polymetallic epithermal/mesothermal veins, (2) gold-bearing breccias/quartz veins (±tellurium), (3) copper-gold/gold porphyries, (4) copper, lead/zinc, and gold skarns and carbonate-hosted deposits, (5) iron skarns and replacement bodies, (6) gold placers, and (7) Th-REE epithermal veins. Some of New Mexico’s largest gold and REE deposits are found within this belt. The Elizabethtown-Baldy district, Colfax County has produced an estimated 14,649,984 g Au. In the Old Placers district, Ortiz Mountains, the Carache Canyon breccia deposit is estimated to contain reserves of 11.7 million metric tons of 1.6 g/t Au and the Lukas Canyon skarn deposit is estimated to contain reserves of 13 million metric tons of 0.9 g/t Au. Production from this district is estimated at 13,996,800 g Au. Gold values in alkaline-igneous deposits are generally higher than other deposits in New Mexico and have high gold/base-metal ratios and low silver/gold ratios, unlike other deposits in the state. Deposits of REE are found in several districts, but typically not with gold. In 1991-1992, USBM calculated an inferred resource of 0.487 million metric tons of total REE (grade of 2.95% total REE) in the Gallinas Mountains district and recent drilling has occurred in the Cornudas Mountains looking for REE. The origin of these deposits is not well understood, but a compilation of new and past data, including new dates and isotopic and chemical analyses of igneous rocks and associated mineral deposits, allows for a better understanding of the origin of these deposits. The diversity of igneous rocks and associated mineral deposits along the boundary of the Great Plains with the Southern Rocky Mountain and Basin and Range provinces suggests that this region is characterized by highly fractionated and differentiated, multiple pulses of magmas. Both upper mantle and lower crustal source rocks may be involved, along with local hot spots. Deep-seated fracture systems or crustal lineaments probably channeled the magmas and hydrothermal fluids. Once magmas and metal-rich fluids reached shallow levels, local structures and wall rock compositions determined distribution of and final style of intrusives and resulting mineral deposits.