Airborne Magnetic and Radiometric Data Provide Insights to Alkaline Intrusive Complexes and Associated REE and Thorium Resources in the Wet Mountains, Colorado

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The USGS Earth Mapping Resources Initiative (EarthMRI) is tasked with improving the Nation's understanding of the geologic framework within which undiscovered critical mineral resources may occur. To help address this goal, in the summer of 2021 an airborne magnetic and radiometric survey was flown over the Wet Mountains region in south-central Colorado, where several Cambrian alkaline complexes are associated with REE and thorium resources. The survey was flown along east-west flight lines spaced 150 m at a nominal terrain clearance of 80 m and covered an area approximately 2,250 km^2.

The resulting aeromagnetic data and maps of equivalent uranium (U), thorium (Th), and potassium (K) exhibit a unique combination of responses over each alkaline complex that relates to their different petrologic characteristics. Pyroxenite and gabbroic rocks at Gem Park produce large-amplitude magnetic highs and low concentrations of K, Th, and U. In contrast, Democrat Creek, which is largely composed of quartz syenite, exhibits a low magnetic response and high concentrations of K, Th, and U. McClure Mountain complex, a mixture of syenites and mafic rocks, shows a complicated magnetic pattern, high K, and low U and Th. The adjacent stratified mafic-ultramafic rocks of Iron Mountain exhibit local magnetic highs and overall low radiometric response. North-northwest trending Th anomalies correlate well with previous mapping of Th-rich veins and dikes and suggest additional structures south of the outcropping alkaline complexes. Farther to the southeast, a magnetic high having similar amplitude and form to that observed over the Gem Park and Iron Mountain intrusions suggests additional gabbro and pyroxenite rocks in the shallow subsurface. Geophysical characterization of the alkaline intrusions and veins help guide the interpretation of their subsurface extents and their possible association with faults, which are also well expressed in the aeromagnetic data as breaks in anomaly patterns.