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Integration of Magnetic and Mineral Occurrence Datasets Over Az, Co, Nm, and Ut: Implications for Archean-Cambrian Basement Control on Jurassic-Eocene Mineralization

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With the demand for metals and critical elements increasing and the discovery of new deposits decreasing, it is increasingly important for regional exploration programs to reduce large and complex datasets into district scale exploration targets. We present an airborne magnetic dataset and mineral occurrence dataset covering AZ, CO, NM, and UT that has been processed to reduce complexity. Magnetic lineaments (high magnetic “ridges”, low magnetic “troughs”, and magnetic source edges) were semi-automatically generated to a depth of 20 km, in 1 km increments. Mineral occurrence data was parsed for Ag, Au, Cu, Mo, Pb, and Zn occurrences. The two datasets were compared to each other and to major geologic features, which tend to be crustal in extent and regional to continental in scale. Areas of moderate to high mineral occurrence density are almost always parallel along distinct and (semi)-continuous magnetic lineaments for upwards of hundreds of kilometers. These mineralized-associated lineaments are spatially related with E-trending Archean and Cretaceous to Eocene; NE-trending Paleoproterozoic; NW-trending Paleo- and Mesoproterozoic, Cambrian, and Pennsylvanian; and NNW- to NNE-trending Jurassic and Cretaceous to Miocene ancient continental margins, basement arc terranes, terrane boundaries, and overprinting orogenic-related structures. Areas of the highest mineral occurrence density are located along NE-, NW-, and E-trending lineaments, especially where they intersect. These relationships suggest that mineralization (dominantly Jurassic to Miocene in age in AZ, CO, NM, and UT) related to magmatism and metamorphism during the Nevadan-Sevier-Laramide orogenies and later extension, was strongly controlled at the regional scale by Archean to Cambrian basement-building features. Occasionally, the same Proterozoic features are associated with mineralization on either side of the unmineralized Colorado Plateau. Using these regional mineralized-associated lineaments and structures as guides, district-scale exploration targets can be defined.