

Battery Metals in Diverse Geological Environments of the Lesser Caucasus, Armenia: An Overview for Future Exploration

Samvel Hovakimyan¹, Robert Moritz², Marianna Harutunyan¹, Karen Hambaryan¹, Kima Charatanyan¹
1. Institute of Geological Sciences of the National Academy of Sciences of the Republic of Armenia, Yerevan, Armenia, 2. Department of Earth Sciences, University of Geneva, Geneva, Switzerland

The Lesser Caucasus belongs to the central part of the Tethyan metallogenic belt, between the Anatolian and Iranian segments. Mineral deposits and prospects of this segment belong to two metallogenic belts, recording diverse geological and geodynamic settings located between the Arabian and Eurasian plates, and ranging from Mesozoic island-arc to Cenozoic collisional and post-collisional settings. Critical and battery metal targets in Armenia include porphyry Cu-Mo, epithermal Au and base metal, Cu-rich and Ba-rich polymetallic type, volcanogenic Mn, and Kiruna-type magnetite-apatite deposits, mine waste and tailings, as well as various magmatic and metamorphic complexes. The existing mines generate huge volumes of waste rock and tailings. They contain significant potential resources of critical metals, including REEs, Cr, Ni, Co, Li, PGEs, Re, Se, Te, Bi, Ge, Ti, W, V, Zr, Th, etc., which are by-products and are typically not recovered during mining.

Cenozoic alkaline and nepheline syenite complexes are considered one of the major potential sources for REEs and represent potential targets for battery metals, including Li, Ni, and Co in Armenia. The Li potential of granitic pegmatite and tourmaline-bearing felsic intrusions of the highly mineralized Cenozoic Meghri-Ordubad pluton in southernmost Armenia remains underexplored. Clay minerals in hydrothermally altered rhyolite, as well as brines of salt mines near Yerevan, might be potential targets for Li resources. Mn prospects in Late Cretaceous volcano-sedimentary rocks along the Somkheto-Karabagh belt of the Eurasian margin in northwestern Armenia remain to be evaluated. Potential targets for REEs and battery metals are carbonatized rocks located along the Jurassic-Cretaceous ophiolite suture zones. The Neoproterozoic metamorphic basement rocks are considered potential targets for REEs and battery metals. Further investigations are required for the assessment of critical metals enrichment of various deposit types, magmatic complexes, and metamorphic basement rocks.