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Critical Metal Potential of Historic Mining Districts in the Lesser Caucasus and the Eastern Pontides, Central Tethyan Orogenic Belt

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The Eastern Pontides and the Lesser Caucasus belong to a continuous mountain belt extending from northeast Turkey through Georgia, Armenia, and Azerbaijan to northern Iran. This mountain belt is well known for its Mesozoic and Cenozoic metallogeny dominated by base metal volcanogenic massive sulfide, porphyry Cu-(Mo), and precious/base metal deposits. The potential for critical metals and strategic by-products remains largely unknown. The best targets are certainly Re, Te, Li, and REEs, but also Sn, In, and Ge, which are discussed below.

Our best knowledge about various critical metals comes from the Cenozoic South Armenian Block located in the Lesser Caucasus. Eocene and Oligocene porphyry Cu-Mo mines in southernmost Armenia and adjacent Nakhitchevan produce Re as a by-product. The full potential and controls of Re enrichment remain unknown in the entire region. It is only recently that Re enrichment has been reported in Cretaceous porphyry systems of the Eastern Pontides. Some Cenozoic epithermal systems of the South Armenian Block contain abundant telluride minerals, but the Te endowment remains unconstrained. The South Armenian Block also hosts post-collision apatite-magnetite and alkaline magmatic ring complexes, containing nepheline syenite, where the potential of REEs and other critical metals has not been investigated. Another target is Li, which remains to be evaluated in post-collision Cenozoic clay-altered rhyolite, in tourmaline-bearing felsic shoshonitic intrusions, and in thermal waters.

There is only fragmentary knowledge about critical metals in older environments, such as Precambrian, Variscan, and Jurassic-Cretaceous settings. Recently, we recognized that Carboniferous intrusions of the Eastern Pontides have geochemical compositions that are comparable to Sn-bearing Variscan intrusions of western Europe. High In concentrations have also been reported in sulfides from a Jurassic-Early Cretaceous(?) porphyry-epithermal setting in southernmost Georgia. Finally, the Eastern Pontides host abundant volcanogenic massive sulfide deposits, where the potential of by-products (Ge, In) must be tested.