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Geological Review of Carbonatites in Ontario with Emphasis on REE, Nb, and Phosphate Mineralization

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There are more than 50 known carbonatite and/or alkalic complexes in Ontario, ranging in age from Neoarchean to Jurassic. Alkaline–carbonatite intrusive complexes in Ontario represent an important but relatively understudied group of rocks that contribute significantly to the province's critical mineral potential. These intrusions, typically emplaced within Precambrian basement terranes, occur as part of multiphase alkaline systems and exhibit diverse mineralogical, geochemical, and structural characteristics. Found in regions such as the Superior Province and Kapuskasing Structural Zone, Ontario's carbonatites commonly include calcite- and dolomite-rich lithologies, together with associated alkaline silicate rocks such as ijolite, nepheline syenite, and pyroxenite. Many of these intrusions were investigated in detail by the Ontario Geological Survey between 1983 and 1993. Although the petrogenesis of many of them has been studied, their mineralogy and economic potential—including their critical mineral endowment—remain poorly understood for many of the occurrences.

Critical mineral strategies at both levels of government have renewed industry focus on carbonatites, driving active claim staking and exploration. Recent exploration interest has been renewed due to the presence of rare earth elements (REE), niobium (Nb), and phosphate within several Ontario carbonatite complexes. Because many of these intrusions are covered by overburden, they are primarily examined through drilling, geophysical surveys, and geological modelling.

Collectively, Ontario's carbonatites provide key insights into Precambrian intrusive processes and host mineral systems of increasing economic relevance. Continued integration of geophysics, drilling, mineral chemistry, and regional tectonic studies is expected to refine models of carbonatite emplacement and advance our understanding of their role within Canada's broader critical mineral framework.

In a new study by the Resident Geologist Program, we are collecting samples from across Ontario to integrate whole-rock geochemistry with petrographic and mineralogical analyses in order to better characterize the mineralization and assess the economic potential of these intrusions. We also plan to conduct geochronological studies on intrusions for which no age data are currently available.