Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37290

Volatile Behavior in Alkaline Syenites, Mont Saint-Hilaire, Québec

PETER TICE

Woodsville High School

The East Hill Suite of the Mont Saint-Hilaire, Québec, alkaline complex comprises an assemblage of alkaline syenites and allied lithologies, including a lamprophyre unit, that are the product of Cretaceous magmatism associated with failed rifting in the Saint Lawrence River valley. Miaskitic nepheline syenite hosts large differentiated masses and dikes of agpaitic syenites characterized by extensive subsolidus alteration involving volatile-rich fluids. Elevated activities of sulfur and chlorine are prominently revealed by the presence of abundant microsulfide inclusions throughout the suite and the nearly total alteration of nepheline to sodalite. Subsequent alteration of the secondary sodalite to natrolite thence to dawsonite indicates evolving fluid chemistry involving late-stage increases in silica and carbonate activity, respectively. This phase of fluid-mediated alteration is hypothesized to have driven alteration in the lamprophyre unit of a primary melilite groundmass to a natrolite-calcite assemblage. Petrographic and geochemical study of the suite defined an $f(O_2)$-T curve that points to decreasing oxygen fugacity with cooling with values ranging from approximately 10^{-10} bar at intrusion down to 10^{-25} bar subsolidus. Data suggest that this curve crossed below QFM shortly after intrusion, went above QFM later in crystallization, and then above HM with cooling. Applying the same techniques to sulfur fugacity revealed an early increase from approximately 10^{-4} to 10^{-2} bar followed by a decrease with cooling down to approximately 10^{-8} bar.