

Magnetic Characterization of 100-90 Ma Plutons in Eastern Alaska: Implication for Intrusion-Related Mineral Systems

Jacob Murchek¹, Douglas Kreiner², Benjamin Drenth³, Jamey Jones²

¹US Geological Survey, Reston, United States, ²US Geological Survey, Anchorage, United States, ³US Geological Survey, Denver, United States

Cretaceous intermediate-felsic plutons emplaced between 100–90 Ma in eastern Alaska and Yukon form a series of metal-rich (e.g., Au, Cu, W) magmatic belts. These include the Wolverine, Shaw Creek, and Harper suites in Alaska and their Yukon correlatives – Tombstone, Mayo, and Tungsten, respectively. Restoring ~430 kilometers of dextral displacement along the Cenozoic Tintina fault aligns these plutonic belts. Although the suites are geologically similar, their aeromagnetic characteristics differ significantly. Aeromagnetic data were coupled with local geology and magnetic susceptibility measurements to evaluate anomaly character and potential sources of magnetic responses.

The Wolverine suite exhibits generally low magnetic susceptibility and a subdued aeromagnetic expression, with localized highs at Sawtooth and Roughtop Mountain correlative with magnetite-bearing phases, and/or interaction with more mafic host rocks. Shaw Creek suite plutons are consistently weakly magnetized and intrude deformed quartzo-feldspathic metamorphic rocks with similar magnetic susceptibilities, limiting magnetic contrast and anomaly generation. Harper suite exhibits the greatest internal variability with a bimodal susceptibility distribution and both strong and weakly magnetized plutons in the aeromagnetic data.

In contrast, Yukon suites commonly produce stronger aeromagnetic responses. While some Tombstone plutons contain strongly magnetized phases, many Yukon anomalies likely reflect pyrrhotite-bearing contact aureoles developed in reduced platform strata of the Selwyn Basin. These sulfide-bearing host rocks promote generation of monoclinic pyrrhotite during contact metamorphism, which may produce strongly magnetized contact aureoles. The Mayo intrusions occasionally produce similar anomalies associated with aureoles, whereas Tungsten intrusions are weakly magnetized but sometimes contain strongly magnetized, pyrrhotite-rich skarns. Correlative Alaskan suites intrude more oxidized host rocks with limited sulfur availability, restricting development of strongly magnetized aureoles or skarns. These results demonstrate that host-rock lithology and redox state strongly influence aeromagnetic expression, enhancing magnetic targeting of intrusion related Au-dominant systems in Yukon but limiting predictive capabilities of these systems in eastern Alaska.