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Research advances on REE-bearing pegmatites in northern Saskatchewan, Canada through cross-sector collaboration

CAMILLE A. PARTIN[1], ALAN CARDENAS-VERA[1], ANA CLAUDIA SANTOS[1], JOSEPH A BRAVO[1], IRVINE R ANNESLEY[1], TANIA MARTINS[1,2], EIMEAR DEADY[3] AND HOLLY ELLIOTT[3]

[1]University of Saskatchewan
[2]Manitoba Geological Survey
[3]British Geological Survey

Critical minerals are essential for societal goals in the transition to greener energy, in particular, the rare earth elements (REE). Canada's priority critical minerals list includes REE, yet there is currently no domestic production of REE. Advanced exploration projects, including those in northern Saskatchewan, demonstrate prospective sources. These include the occurrence of U-Th-REE pegmatites of the Wollaston Domain corridor in northern Saskatchewan that have potential for several REE including Ce, Nd, and Pr hosted in monazite. Broadly, the pegmatites were emplaced during peak thermal events associated with the ca. 1.8 Ga Trans-Hudson orogen, likely as anatectic melts since they have not been shown to be associated with a parental granite. Granite-greenstone belts associated with the Trans-Hudson orogen in SK contain >10 critical minerals (e.g., Cu, Zn, Ni, REE, graphite) and thus understanding its overall geological context is essential for exploration of these commodities. Ongoing work in our project is contributing to understanding when and how (melt sources, structural control) these pegmatite bodies were emplaced, as well as their tectonic context with major shear zones that bound the Wollaston Domain.

Industry-government-academia partnerships provide unique capacity for addressing the problem at multiple scales; industry can provide site access, data, and intimate knowledge of the deposits, offering a springboard for research on these rocks. Our NSERC-NERC project combines boots-on-the-ground fieldwork with detailed mineralogy, mineral chemistry, geochronology, and isotopic work on the pegmatites leading to an integrated igneous and metamorphic petrogenetic model that also incorporates 3D geophysical modelling essential to understanding and predicting where REE-rich pegmatites occur. Relevant to REE, our partner the Saskatchewan Research Council will have the Rare Earth Processing Facility online in 2027 that can produce Pr, Nd concentrates. This cross-sector collaboration serves to strengthen the scientific purview of the project overall, leading to corollary deliverables and toolkits that benefit the geoscientific community, government, and industry.