

Heavy mineral compositions in Saskatchewan till: classification and constraints on source, with a focus on garnets

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Glacial sediments of varying thickness cover much of Saskatchewan's landscape, creating significant challenges in mineral exploration within the underlying rocks; nonetheless, the same glacial processes that make exploration so problematic in these areas can also provide a means of facilitating it. The scouring of bedrock by glacier ice often leads to the entrainment and transport of rock debris, later deposited as till. Within this till, there may exist heavy minerals indicative of mineral deposits previously eroded by the glacier. If dispersal trains of these indicator minerals can be identified, they can be traced back to their original source based on an understanding of historical ice flow directions. This study investigates a suite of heavy minerals, with a focus on garnets and ilmenites, recovered from till samples of an active diamond exploration project in Saskatchewan. The minerals have been analyzed using the electron microprobe to determine their composition, and to identify mineral inclusions, chemical zonation, and internal textures. Preliminary results indicate that the garnets are not zoned and are dominated by the pyrope component, with up to 12 wt. % Cr_2O_3 . Evidence suggests that these garnets may be derived from metasomatized lithospheric mantle, similar to those of the Fort à la Corne kimberlites located on the Sask Craton. Some of the ilmenites, which preserve complex internal textures, are Mg-rich and may be derived from a similar source. The mantle-derived garnets will be further studied in order to shed light on the pressure-temperature conditions and mantle composition at the time of their formation, and to determine if these conditions were appropriate for the formation of diamondiferous kimberlites.