



## **An overview of the Mud Lake Kimberlite, SW Slave craton, Northwest Territories, and implications of the presence of high $\text{Cr}_2\text{O}_3$ , CaO-rich green garnets**

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The discovery of diamondiferous kimberlite in the Lac de Gras region of the Slave craton initiated an unprecedented diamond-driven staking rush, principally focused in the central Slave, proximal to known diamondiferous deposits. With their discovery throughout much of the craton, we now recognize that Slave kimberlites occur in temporally and petrologically distinct “fields”, characterized by individual pipes and pipe clusters. The Ordovician-Silurian (ca. 441-463 Ma) southwestern Slave field, best known because of the ca. 25 ha, diamondiferous Drybones Bay kimberlite, has received little attention compared to the central and southeastern Slave fields.

The Ticho Diamond Project, operated by Snowfield Development Corporation (SNO), is located in the southwestern kimberlite field, ca. 50 km south-southeast of Yellowknife on the eastern shore of Great Slave Lake. Initial exploration in the area was largely driven by regional till sampling programs conducted by the Geological Survey of Canada and prospector David Smith. Till samples collected in the early sampling programs revealed elevated numbers of kimberlite indicator minerals including pyrope garnet, chromite and picroilmenite. Follow-up investigations in 2003 (SNO) resulted in the discovery of the Mud Lake kimberlite (MLK).

The MLK comprises a NNE-trending, SW-dipping, sill-like body generally continuous along strike for  $\geq 800$  m and, although bifurcating, ranges in thickness from  $<1$  to 7 m. The freshest portions of the MLK consist of: abundant (45 volume %,

$\leq 5$  mm) serpentinized olivine grains along with less common, phlogopite ( $< 5\%$ ,  $\leq 5$  mm) and picroilmenite ( $< 2\%$ ,  $\leq 5$  mm) grains. Pyrope, typically with kelyphitic rims, is common and set in a fine-grained groundmass of serpentine, carbonate and opaque minerals. Paragenetically late hematite and associated reddening of the kimberlite and country-rock is widespread. Breccia zones are locally observed at the structural top of the MLK, and contain  $\leq 90\%$  rounded to angular country-rock xenoliths in a carbonate matrix. Caustic fusion analysis on drill core from the sill has recovered promising macro diamond contents, the two largest stones being  $\geq 2$  mm in their longest dimension. Snowfield Development Corporation has since removed the granite country-rock cap from a portion of the MLK sill and retrieved a 500 tonne bulk sample currently being processed for diamond content.

We review historical, mineral industry assessment report information, and present new petrographical, electron microprobe and LAM-ICP-MS mineral chemical, X-ray diffraction and U-Pb geochronological data on samples of the MLK exposed during the recent bulk sampling, in order to better document the MLK. Comparisons with the adjacent Dry Bones Bay kimberlite and other pertinent global localities help provide a better understanding of the origin of the enigmatic high-CaO, Cr<sub>2</sub>O<sub>3</sub>-rich garnets.