

Temperature Constraints during Emplacement of the Parkin Offset Dyke, Sudbury Impact Structure, Canada

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Abstract

The Sudbury impact structure is widely recognized as a 1.85 Ga 200- to 250-km tectonically altered multi-ring impact basin located in central Ontario, Canada. There are seven radial dykes, three concentric and two discontinuous dykes surrounding the Sudbury Igneous Complex (SIC). The radial dykes are often linked to the SIC via an embayment structure(s) that typically contains abundant sulfides. The Offset dykes are traditionally separated into quartz diorite and inclusion bearing quartz diorite phases. The inclusion-bearing phase is associated with disseminated to massive Ni-Cu-PGE. The Whistle-Parkin is a 12 km radial Offset dyke located in the northeast corner of the impact structure. The Whistle extends for 1.5 km from a 0.5 km long and 250 m wide embayment, where it is then apparently displaced ~2 km to the northwest. Beyond the apparent displacement is the Parkin portion of the dyke, which is known for another ~10 km to the northeast. The Parkin cross cuts the Espanola Formation of the Huronian Supergroup at ~6 km from the SIC at the Milnet Mine Zone, which is an ascending sequence of limestone, siltstone and dolostone. Samples taken from the contact between the Espanola Formation and the dyke were analyzed via powder- and micro-X-ray Diffraction. A variety of minerals; Åkermanite, Hedenbergite, Pargasite and Richterite, typical of thermally metamorphosed limestones in contact metamorphic zones were discovered in close proximity (< 1 m) to the dyke within the Espanola Formation. Cristobalite was also found in close proximity to the dyke, indicating the Espanola Formation was heated to high temperatures (> 1470°C) due to contact metamorphism from the dyke. Several control samples were analyzed at various distances (up to 2 km) away from the dyke to ensure that this was not a regional metamorphic event.