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The kinematic relationship between thrusting, reverse faulting and transpression: An example from the Sudbury Basin, Canada

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The synformal Sudbury Igneous Complex (SIC) is the deformed relic of a large impact melt sheet. Understanding the geometry and kinematics of deformation of the SIC is paramount for mineral resource deposit exploration of this complex, constraining its pre-impact configuration and understanding Paleoproterozoic tectonism at the southern margin of the Archean Superior Province. In particular, it is uncertain to what extent thrusting on the South Range Shear Zone (SRSZ), a ductile shear zone transecting the southern portion of the SIC, is coeval with folding and transpression in the eastern part of the SIC. Geometric properties of 1090 discontinuities mapped from air photos and geometry of metamorphic L-S fabrics revealed the presence of two spatially and kinematically distinct deformation regimes in the southern SIC, the so-called South Range. NW-directed thrusting on the SRSZ dominates in the western South Range, whereas dextral transpression prevails in the eastern South Range. The two deformation regimes are geometrically and kinematically related to the SRSZ. We propose that the SRSZ transects the South Range south of the SE-lobe, a tight fold of the SIC. This is at variance with previous hypotheses in which the SRSZ continues into the hinge zone of the SE-lobe and in which dextral transpression is spatially confined largely to this lobe. The curvature of the SRSZ and its mechanical coupling to its footwall rocks imparted dextral transpressive deformation to the eastern South Range. Dextral shear component of this deformation was associated with shortening of the SIC oblique to its contacts. Collectively, this led to map-view corrugation of SIC contacts and thickness variations of the SIC that culminated in the formation of the SE-lobe. Our study suggests that thrusting on the SRSZ is kinematically linked with transpressive deformation and coeval with large scale folding of the SIC.