

Pseudotachylitic Sudbury breccia formed in basement rocks below an impact melt sheet represented by the present-day Sudbury Igneous Complex (SIC). Its origin has been attributed either to shock compression and cataclasis during propagation of an impact shock wave, to frictional melting and cataclasis during large slip displacements along crater collapse superfaults, or to injection of superheated melts from the overlying impact melt sheet into dilational fractures that opened during collapse of the crater. In an effort to test these models, the compositions of Sudbury breccia in the North Range and South Range of the Sudbury impact structure are compared to the compositions of the rocks hosting the breccia and to the average composition of the SIC. Major and trace element systematics suggest that the breccia formed *in situ* by mixing of its comminuted host rocks. The distinct chemical composition of the SIC argues against the involvement of the impact melt sheet in the makeup of the breccia. The similarity in the compositions of the breccia and its host rocks further argues against the generation of the breccia along superfaults followed by its injection into the fault wall rocks. The strong local host control on chemical and clast compositions of the breccia indicates that it formed *in situ* by shock-induced compression and cataclasis of its host rocks during propagation of the shock wave. Further comminution and cataclasis of the host rocks occurred along pre-existing anisotropies and fractures that formed and were reactivated during the growth and collapse of the transient crater, as indicated by the presence of breccia clasts within breccia.