CHARACTERISTICS OF THE EJECTA LAYER FROM THE 1.85 GA SUDBURY IMPACT EVENT: ARE ANALOGOUS SEDIMENTS PRESENT ON MARS? Philip Fralick, Department of Geology, Lakehead University, 955 Oliver Road, Thunder Bay, Ontario, Canada, P7B 5E1, philip.fralick@lakeheadu.ca.

At 1850 Ma an object, probably in excess of ten kilometers in diameter, struck the edge of Superior Craton in the area that is now Sudbury, Ontario. The impact produced the second largest known crater on the surface of the Earth, propelling an immense amount of material into the atmosphere. Twenty-five million years prior to the collision the southern margin of Superior Craton west of the impact site consisted of a continental volcanic arc separated from the continent proper by an extensional backarc basin collecting chemical sediment of the Gunflint Formation. At the time of the impact, orogeny to the south of present day Lake Superior had caused the sea to withdraw from the northern portion of the basin and possibly from the entire basin. The ejecta blanket landed in this setting, was altered by subareal diagenesis and fifteen million years later was buried by sediment of the transgressing ocean. Thus, in some areas preserving a record of deposition from what was probably the expanding base surge of the impact event.

Addison et al. (2005) first discovered this layer, which has since been described by Pufahl et al. (2007), Cannon et al. (2010) and Addison et al. (in press). To date over thirty outcrop and core sections through the layer have been found. It is extremely laterally variable, ranging from totally absent in some sections to tens of meters in thickness in others. Sections within a few hundred meters of one another can be composed of different material with contrasting textures and sedimentary structures. Common components of the deposits are: 1) pebbles to boulders of Gunflint chert and carbonate, 2) pebble and granule sized devitrified glass, 3) 3 to 20mm accretionary lapilli, 4) unshocked quartz and feldspar grains, and 5) quartz with planar features (PDFs). Where pebble-sized devitrified glass is common lapilli are usually absent. Conversely, sections with lapilli in grain-support commonly do not contain devitrified glass. Massive carbonate and silica replacement has occurred; with first blocky calcite cements developed then overprinting (including lapilli) by quartz and iron carbonate. This lithified material occasionally collapsed forming boulder piles along what were probably fault scarps.

The two most typical types of successions are: 1) up to 7 meters thick boulder conglomerates with devitrified glass ± lapilli, and 2) thin (averaging approximately 50 cm) graded sand- to granule-sized material with lapilli. The thick successions commonly overlie fractured to shattered bedrock with large rotated blocks. In other areas the boulder conglomerates overlie what had been water-saturated mafic ashes that liquefied allowing sinking of brecciated, solidified chert layers. Calculations suggest this area would have experienced an earthquake of approximately magnitude 10, quite capable of producing these effects. The overlying disorganized pebble to boulder conglomerate contains clasts up to 3.5 meters in length that are commonly in matrix support, but in some areas are in clast support. Pebbles to cobbles of devitrified glass can be mixed throughout the matrix or may appear only in the upper half of the conglomerate. Rarely, the matrix-supported conglomerate is separated from the underlying rock by approximately one meter of clast-supported, trough cross-stratified lapilli, with possible chute and pool structures, interlayered with sand to granule-sized material. In some areas the conglomerates are organized as a series of stacked channels that decrease in size upwards with small channels near the top filled with the first appearance of lapilli. In other areas lapilli are scattered between the disorganized boulders of the massive deposit. Parallel laminated lapilli in clast support or massive lapilli in clast or matrix support can overlie the conglomerate. Alternatively, in places it is overlain by a massive layer of devitrified glass pebbles or a thick succession of massive or large-scale cross-stratified sand-sized material. These thicker successions appear to fill depressions. The thinner units overlie intact bedrock, which apparently was swept clean of the earthquake debris. They commonly show grading, consisting of either: 1) one or more successions that are normally graded from sand and granules, with lapilli, to silt, or 2) are reverse then normally graded with the granules and lapilli concentrated in the middle of the tens of centimeters thick unit.

This talk will present photographs of the various layering successions, allowing the audience to contemplate any similar features they have observed in photographs from Mars.

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