THE NATURE AND ORIGIN OF THE ENIGMATIC GARSON MEMBER OF THE SUDBURY IMPACT STRUCTURE, CANADA. A. B. Coulter[1], G. R. Osinski[1] and R.A.F. Grieve[1], [1]Centre for Planetary Science and Exploration/Dept. Earth Sciences, University of Western Ontario, 1151 Richmond Street, London, ON Canada N6A 5B7 (acoulte6@uwo.ca, gosinski@uwo.ca).

Introduction: The 1.85 Ga, ~200 km diameter Sudbury impact structure is a tectonically altered impact basin located in central Ontario, Canada [1]. The structure is composed of three major constituents, from the centre of the crater outwards they are: the Whitewater Group, the Sudbury Igneous Complex (SIC) and the country rocks [2]. From youngest to oldest, the Whitewater group consists of four Formations: Onaping, Vermillion, Onwatin and Chelmsford [3]. The Onaping Formation is a 1.4-1.6 km thick complex series of breccias and melt bodies which is subdivided into three Members, from bottom to top: Garson, Sandcherry and Dowling Members [4].

The Garson Member is up to 500 m thick and is restricted to a 25 km strike length in the SE lobe of the impact structure [4]. The Garson Member has been previously described as comprising thickly bedded to massive fragmental rocks dominated by >20 to 85% Huronian quartzite fragments (<6 cm) and blocks (>6 cm to 50 m), and contains up to 15% vitric andesite lapilli, and <5% vitric andesite bombs and blocks [3]. These properties set it apart from any other member of the Onaping Formation. Furthermore, the reason(s) as to why the Garson Member is restricted to the SE of the Sudbury structure remains unanswered, providing motivation for this study.

Methods: Detailed mapping and sampling of the Garson Member took place during summer 2012. Laboratory analyses at the University of Western Ontario included optical microscopy, powder X-ray diffraction (XRD), micro X-ray diffraction (µXRD), X-ray fluorescence (XRF), inductively coupled plasma atomic emission spectroscopy (ICP-AES), and backscattered electron (BSE) imaging coupled with energy dispersive X-ray (EDX) spectroscopy on a scanning electron microscope (SEM).

Results: Massive quartzite clasts (~75%) set in an aphanitic groundmass (~25%) accounts for the entirety of the Garson Member. The clast size and shape in the Garson Member displays extensive variation from 10's of m's to only cm's. There was a general decrease in clast size moving upwards through the Garson Member towards the Sancherry Member. In addition, there was an apparent increase in deformation of the clasts, as they showed signs of east to west elongation. Along with the elongated quartzite clasts, many Quartz veins were found following the same east to west trend.

Petrology. Clasts were confirmed to be consistently dominated by quartz (≥95%). The remaining ≤5% contained variable amounts of K-feldspar, plagioclase, muscovite and chlorite. Chlorite overprints both the clasts and groundmass. Planar deformation features (PDFs) were noted within the quartzite clasts. The major phases in the igneous-textured groundmass included: ~40-55% quartz, 10-25% K-feldspar, 5-20% chlorite, <5% plagioclase, <5% muscovite and <5% opaques.

Geochemistry. XRF and ICP-AES analyses of the least altered groundmass samples suggests a close relationship to the Onaping Intrusion, while the Sandcherry Member and the Granophyre do not seem to be as closely related.

Discussions: The presence of shocked clasts and an aphanitic groundmass of igneous origin provides justification for the reclassification of the Garson Member as a clast-rich impact melt rock. The geochemical similarities between the Garson Member and the Onaping Intrusion and their similar stratigraphic context – i.e., between the SIC and the Sandcherry Member of the Onaping Formation – potentially suggest a similar origin.

Recent research has suggested the Onaping Intrusion actually represents the roof rocks of the SIC, as this melt sheet lacks a clast rich upper phase [5, 6 – Anders et al. this conference]. As such, it is proposed that the Garson Member, like the Onaping Intrusion, represent the roof rocks of the SIC. There are, however, several differences between the Garson Member and the Onaping Intrusion, including different clast size and shape, clast lithology and groundmass texture. A new model of the Garson Member has been developed to account for these differences, in addition to supporting the roof rock theory.

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