THE MISTASSINI-OTISH IMPACT STRUCTURE, NORTHERN QUEBEC, CANADA: AN UPDATE

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Introduction: Six years ago, a 2,1Ga meteorite impact event has been proposed to explain many field and microscope observations concerning the Otish Basin (OB) and the Chibougamau mining camp (CMC) [1]. The hypothesis also included the Mistassini Basin (MB) for which we had no impact evidence until the 2015 field work. Since then, our lab work and field surveys have been fruitful. So, an update is deemed to be useful.

Geological framework: The study concerns all the proterozoic units observed within the area, i.e. northeasterly, the Chibougamau Formation (CF), the Mistassini Group (MG) and the Otish Group (OG). All the relevant units lie on the archean basement made of gneisses, granitoids and greenstone belts pertaining to the Superior Province. The CF is composed of a diamictite which is overlain by conglomeratic sandstones. Its distribution is restricted to a chain of half grabens striking northeasterly and parallel to the Grenville Front (GF). The MG has been subdivided into four formations, namely from base to top: the Papaskwasati (grey conglomerates and sandstones), Cheno (black sandstones), Albanel (dolomites) and Temiscamie (iron formation) [2] [3]. Nevertheless, this stratigraphic relationship remains questionable because there is a lack of data in between the Cheno and Albanel formations. The OG has been formally subdivided into two formations, the Indicator and the Peribonca (PF) formations [2]. The Indicator is made of two fining upward cycles starting with quartz pebble conglomerates at the base, whereas the two upper cycles of the PF start with polymictic conglomerates settled within an oxidizing environment. The uppermost unit of the PF has been invaded by a trap-like gabbro which locally grades to a basalt intertongued with red beds. The gabbro emplacement has been controlled by the topography and its final setup reflects the conjugated action of the uprightness of the sedimentary units with the uplifting of the basement to the southeast.

Highlights: The chief results of regional surveys conducted in 2015 and 2016 will be pointed out, as well as the results obtained from laboratory works dealing with petrography, universal stage analyses, SEM-BSE and SEM-CL. A synopsis of the best evidences supporting the Mistassini-Otish Impact Structure (MOIS) follows.

CMC: The observations associated to the MOIS are: breccia dikes containing shocked clasts, devitrified glass fragments and spherules, the CF which contains glass fragments, spherules and shocked clasts, PDFs, shatter cones (to be confirmed) and likely the orphaned shatter cones of Presqu'Île lake.

MB: The observations associated to the MOIS are: a one meter thick spherule layer [4] [5], ubiquitous spherule-rich dolomites, a thick carbonate melt, carbonado-like carbon allotrope fragments and melted clasts that fell within the carbonate melt, micro-diamonds, carbon glass, suevitic breccias containing accretionary lapillis and abundant glass fragments, controversial shatter cones (vs hackle marks), other *bona fide* shatter cones, the Mistassini dike swarm, the arcuate shape of the Mistassini and Albanel lakes, and likely the shatter cones of Rouleau Island.

OB: The observations associated to the MOIS are: PDFs and PFs observed in the sandstones, the global structural pattern, large enclaves containing shocked fragments at the base of the Otish gabbro which is interpreted as a melt, growing evidences that the base of the PF is the product of an ejecta reworked by a tsunami, the structural style of the inliers south of OB, and an undeformed 60 m large polymictic mega-breccia dike observed south of the GF and parallel to it.

The model: Together CMC, MB and OB constitute a nearly 450 km long arcuate segment made of paleoproterozoic sediments lying on an archean basement and ending within the Grenville Province. The GF is not the limit of the paleoproterozoic sediments but the locus of a major vertical faulting induced by the uplift of the basement rocks. Interestingly, in spite of that uplift, the gabbro sheet stays in a horizontal position and at the same topographic level observed in the OB. So, the gabbro position has not been modified by the uplift and was instead gravitationally driven. Such an emplacement of a trap-like magmatic layer, synchronous with an uplift, can easily be explained by a readjustment observed within a multi-ring impact structure. According to our model, CMC, MB and OB all are located inside one of the inner basins of the Mistassini-Otish multi-ring impact structure. The event could have occurred between 2515 Ma (Mistassini dike swarm) and 2169 Ma (Otish gabbro) [4] [6] [7]. The transient crater reached the upper mantle and its readjustment has likely triggered the exhumation of the anorthosites. The associated Fe-Ti-P ores are thought to be the source of the P-rich spherules found in the Mistassini Lake area.

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