

Mistassini-Otish Impact Structure I: Petrography and geochemistry of the phosphorus-rich Mistassini Spherule Layer (MSL).

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The MSL has been found in 2016 on the north shore of the Mistassini Lake. The HCl insoluble residues revealed usual splash forms such as sphere, discoid more or less concave, oblate, pear-like, dumbbell, teardrop, gherkin, golf club, more or less elongate droplet, and other complex forms with coalescence of microspheres. Spherules and fragments cover 85% of the thin-sections, the spherules being largely dominant (82%). Sub-angular to angular fragments compose the remaining 3%. The dolomitic matrix is shared between the fibrous rims which surround the spherules and fragments (10%) and the remaining true matrix composed of dolomite, with traces of quartz (5%). The maximum spherule size is about 2.5 mm and the mean size is slightly under a millimeter.

Not less than 876 analyses have been done in order to characterize the spherule components with SEM-BSE, SEM-CL and SEM-EDS. Obviously, there is a dichotomy in the composition of both spherules and matrix. The matrix is nearly totally devoid of trace elements whereas an important variable component of metallic elements is associated to the inner constituents of the spherules. The phosphatic materials, especially the phosphorous amorphous microspherules masses have a larger and more various metallic contents than in the other spherule types.

A sample has been submitted to a chemical analysis. The CaO, MgO and LOI contents totalize 82.7 in wt%, of which 12% is carbon with only 0.14% of organic origin. The other results of interest are mainly low Al₂O₃, a Fe₂O₃ content of 2.17%, a SiO₂ content that reflects the spherule composition, a relatively high P₂O₅ content that confirms the phosphorous amorphous microspherules (and apatite crystals) observed in nearly 35% of the spherules, and a relatively high Y content that is often associated with the phosphorous spherules.

Dr Philippe Claeys performed the XRF mapping of Ca, Sr, Si, P, Fe, Mn, S, Ni, and Y. The immiscible silicon and phosphorus appeared to be the main constituents of the spherules beside the calcium. Iron is associated with the siliceous shells of the spherules. Calcium is ubiquitous in the matrix and is found in some spherules as dolomite, calcite, phosphate glass and apatite according to microscopic observations. An interesting finding about the XRF mapping is a 3 mm-sized Ni-P-Y-bearing spherule.