

CARSWELL IMPACT STRUCTURE, SASKATCHEWAN, CANADA: GEOLOGICAL, PETROGRAPHICAL AND GEOPHYSICAL RESULTS, AND IMPLICATIONS FOR THE AGE OF THE ASTROBLEME. I. Duhamel,^{1,2} S. Genest,² F. Robert,² and A. Tremblay¹. ¹Université du Québec à Montréal, Département des Sciences de la Terre, 201 Ave. Président-Kennedy, local PK-6125, 6e étage, Montréal (Québec), H2X 3Y7, Canada. E-mail: duhamel.isabelle@courrier.uqam.ca; tremblay.a@uqam.ca. ²Omégalpha, 539 Route 131, Joliette (Québec), J6E 7Y8, Canada. E-mail: omegalpha@qc.aira.com.

The Carswell astrobleme, in northern Saskatchewan, is a 39 km wide complex impact structure located in the Athabasca Basin of Proterozoic age which shows an 18 km diameter central uplift composed of Aphebian gneisses and granitoids.

During the past two decades, controversy has been raging over the age of the Carswell structure. Two dating hypotheses have been proposed: an Ordovician age impact event sustained by the regular shape of the astrobleme in the sedimentary units [1, 2] and an older catastrophe event, possibly pre-Athabasca, suggested by the lack of impact breccias and shock metamorphism effects in the Proterozoic cover [3, 4].

Our group has carried out field works and an extensive petrographic study on the Carswell impact lithologies encountered in drill cores and hand samples of the Athabasca sediments, the basal conglomerate surrounding the central uplift and the highly brecciated basement lithologies. The basement rocks in the central uplift show evidence of shock metamorphic features ranging from 2 to a minimum of 45 GPa (shatter cones, multiple sets of PDFs, diaplectic glasses, mineral melts). The quartz grains of the basal conglomerate show PDFs and cataclastic textures. On the other hand, the proximal proterozoic sedimentary cover, viewed as to have been impacted by earlier workers (the younger age hypothesis), shows no evidence of shock metamorphism nor of any deformation.

In addition, vertical derivative Bouguer gravity anomalies [5] indicate that the central uplift is well expressed by its positive signature. It is also surrounded by a strongly defined negative well followed by a ring of small positive anomalies probably related to subsidiary basement uplifts. This peak ring is more or less located beneath a pristine stromatolitic reefs unit which confers a circular shape to the sediments surrounding the central peak.

Furthermore, paleogeographic features throughout the Athabasca Basin (paleocurrents and isopach maps [6]) suggest that the sedimentation of the Athabasca Group has been controlled by a bowl shape basin roughly centered on the Carswell central uplift, acting then as a paleo-high.

Therefore, our research suggests that the Carswell event is older than the deposition of the Athabasca Basin and that the actual circular structure is quite probably the central peak, a local expression of a larger multi-ring impact structure hidden beneath the sediments.

References: [1] Pagel M. 1975. Thèse Doc Spéc., Univ. Nancy I, France, 157 p. [2] Harper C. T. 1983. Ph.D. thesis, Colo. School Mines, Golden, Colorado. [3] Currie K. L. 1967. *Nature*, Lond., 213: 56-57. [4] Duhamel I. et al. 2004. *Meteoritics & Planetary Science* 39(8) Supp., p. A32 (Abs.) [5] Miles W. and Slimmon W. L. 2000. Geological Atlas of Saskatchewan Web page. GSC and Sask. Ind. Res. [6] Ramaekers P. 1990 Sask. Geol. Surv., Sask. En. Min., Rep. 195, 49 p.