

### A RE-EVALUATION OF THE SIZE OF THE CARSWELL ASTROBLEME, SASKATCHEWAN, CANADA.

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The Carswell impact structure, centered at latitude 58 °27'N and longitude 109°30'W in northern Saskatchewan, Canada, is located in the Athabasca Basin of Proterozoic age. Past works on the Carswell area were focused on metallogenic research and the study of the impact structure itself was very limited. Since 1983, works have been done around and inside the Carswell structure, core drilling, geochronological and geochemical analysis, and basin depositional analysis were done. The results of these studies are as follow:

Deep diamond drillhole (>1 km deep) in the sediment have been done near the central peak and no breccias have been identified in the cores. Shock metamorphic features (shatter cones, pseudotachylite, suevite) are located in the central peak only which basically consists of granitic gneisses and pelites and pegmatoids which have all retrograded from granulite facies.

Ages for hydrothermalism in sediments found right at the contact of the central peak and those from outside the Carswell structure have coherent ages of 1260 Ma [1].

Vertical derivative Bouger anomaly map [2] shows the high gravity anomaly of the central peak surrounded by a negative annular shape which is itself surrounded by small positive peaks numbering about a dozen (0.5 to 2.5 km wide each). As the sediments of the Athabasca Basin show no influence in the variation of specific density of the rocks, it is estimated that the annular gravity low is associated with the basement. The absence of breccias in the sedimentary units of the Carswell structure suggests that the brecciated impact units (less dense) are in the basement rocks, so implying a pre-Athabaskan age for the Carswell impact structure.

Paleocurrents and isopach maps [3] of the Athabasca Basin show that a large bowl shape surrounding a paleohigh centered on the Carswell structure was already available in the basement. This paleo-topography controlled the sedimentation of the Athabasca Group. The annular shaped dolomitic unit, overlying the positive gravity peaks rings mentioned above, at the current erosion level could correspond to the destabilisation of the central peak during sedimentary compaction. Differential compaction on a peak ring would have created an annular graben in a mechanism similar to the one in Utopia Planitia on Mars [4].

The Carswell impact structure is therefore older and larger than previously estimated [5, 6]. Using both Rondot's [7] and Grieve's [8] models for complex impact structure, the central uplift (38 km) considered to be underneath the annular dolomitic unit would suggest a crater size in the basement of 118 to 125 km wide. This value is a minimal one and fits data from paleocurrents and isopach maps done by Ramaekers on the Athabasca Basin.

References : [1] Ey F. (1984) Thèse Doc Spéc., Univ Strasbourg, 165 p. [2] Miles W. and Slimmon W.L. (2000) Geol. Survey Canada and Sask. Indust. Res in. Geological Atlas of Saskatchewan web page. [3] Ramaekers P. (1990) Sask. Geol. Surv., Sask. En. Min., Rep. 195, 49 p. [4] Buczkowski D. L. and Cooke M. L. (2004) JGR, 109, E02006, 8 p. [5] Harper C. T. (pers. comm. 2004). [6] Harper C. T. (1983) Ph.D. thesis, Colo. School Mines, Golden, Colorado. [7] Rondot J. (1994) Earth-Science Reviews 35(4), p. 331-365. [8] Grieve R. A. F. (1998) Geol. Soc. Spec. Pub. 140, p.105-131.