HIGHLIGHT OF TWO SUPERPOSED DEFORMATIONS IN THE TIN BIDER IMPACT CRATER (TINHERT PLATEAU, CENTRAL SAHARA)

D. Belhaï[1] et F. Kassab[1]. 1(LGGIP, FSTGAT/University of Sciences and Technology Houari Boumediene, BP 32, El Alia, Algiers, Algeria (dbelhai2001@yahoo.fr))

Introduction: The circular structure of Tin Bider is located in the plateau of Tinrhert, north-east of Tidikelt and Reg Açfer, 265 km east of In Salah and 560 km north of Tamanrasset. It is a complex crater which is located on the 1 /200,000th scale topographic map of Tilmas Lamra, at the following coordinates: 27 ° 36 'North and 05 ° 07' East. There is a central part (piton) which is formed of albian sandstones, surrounded by three limestone ridges (crowns) of Cenomano-Turonian age; they are separated by a Cenomanian marl. Two limestone rings of Senonian age are known at Tin Bider, they are separated by clay formations [1] . Analysis of the structural markers (faults, folds, cones of shock and microstructures) induced during the meteorite shock and the post-shock effect allows to characterize this structure and to discuss its evolution.

Deformations Related to Meteorite Impact: A detailed structural mapping makes it possible to demonstrate two undoubtedly quasi-synchronous superposed deformations of the meteorite shock at the origin of this circular structure of Tin Bider.

Deformations Related to the Main Impact:

A- Microstructural Markers: Microscopic analysis shows Quartz deformations due to a shock caused by meteorite impact. The Albian sandstones of Tin Bider (central peak) are shocked in stage 3a, this is attested by the sandstone elements found in the Breccias [2].

B- The Folds: The folds F1 of the phase D1 are linked to the main shock wave whose material goes in the propagation direction of the wave and whose intensity decreases towards the outside, which generates folds, these folds F1, are oriented in a tangent direction at all points to the circular structure. This intense folding affects the layers whose intensity increases from the periphery towards the center of the crater. The Ramsay method (1967) of the different folds taken from each ring showed an increasing gradient from the almost tabular terrains of the periphery to the center where the layers are strongly folded and laminated (class 1b to class 3) [1]. This first phase D1 is linked to the main shock which its compressive stress vectors are divergent and generate folds with tangent axes.

The Folds F2: The presence of superimposed folds of perpendicular orientation is highlighted for the first time in the Crater of Tin Bider which allows to sequence the evolution of the deformations during the episode of craterization. They are oriented perpendicular to the tangents of the circular structure and are therefore radial and converge towards the center of the Crater. They are with plunging axes and pleat at right angles the folds F1. The deformation of the Quartz grains is demonstrated by the SEM In addition to the PFs, PDFs, which were born during the main shock, consequently during the deformation D1, FFs which are short, spaced, parallel to sub-parallel lamellae . The inclination of the axes of the folds F2 increase from the periphery towards the center until becoming vercales in the center of the crater. The markers show that it is in the constriction zone, compatible with the raising of the central peak. FFs are caused by shearing of PFs at the time of decompression (during the modification stage) [2]. We interpret them as being related to the deformation D2.

Discussion and Conclusion: Several stations along the four cardinal points of the crater were examined and the stereographic projections of the fold axes showed tangent orientations for the P1 and radial plies for the F2 folds. The folds P2 are linked to a phase D2 posterior to D1 and taking up at right angles the folds F1. This orientation of the more open and straightened second-generation folds are related to a rotational mechanism with respect to the primary shock wave. The main mechanism that induces this rotation is the formation of the central peak which follows the main shock wave. The upward extrusion of this peak has resulted in the formation of folds with rectified axes and radial orientation as can be observed in the model of a drop which falls into a basin. This simulation of the impact of the drop of water on a liquid surface makes it possible to observe, in slow motion, the origin of waves towards the outside analogous to the folds F1 and the center which lifts in a peak analogous to the central peak to which are associated the radially oriented folds with respect to the center.

References: [1] Belhai D., Merle.O., Vincent.P, Devouard B, Afalfiz. A., (2006). *Bulletin du Service Géologique de 1'Algérie. Vol. 1* 7*, n2, p. 95-112.* [2] Sahoui R., Belhai D., and Jambon A. 2016. Arabian Journal of Geosciences 9: 641-649.