TIN BIDER CRATER (ALGERIA): NEW FIELD DATA AND SHOCK METAMORPHISM

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Tin Bider is a 6km diameter crater situated 265 km East of In Salah town (27°36' N005°07'E). It affects a thick sedimentary rocks (500m) of albian sandstones, upper cretaceous limestones and shales and senonian limestones, marls with gypsum. [1] described three anticlines (A1, A2 and A3) separated by three synclines (S1 and S2 and S3) without definition of different parts of an impact crater (central pick, rings…). [2] reported different types of folds from the crater center to its rim.

Field study: Radar images TanDEM-X recovered from « German Aerospace Center (DLR) » show four circular ridges: R1, R2, R3 and R4 of respectively 1,5 km, 2 km, 3,5 km and 6 km diameter. Most important heights are known at R4 (704m); R1, R2 and R3 are characterized by heights of about 553m. Our field investigation allows us to define the lithological and structural character for the ridges, from the center to rim we defined: R0 vertical and formed on albian sandstones; R1and R2 are monoclinal and formed on cenomanian and turonian limestones; R3 is completely folded and affected senonian limestones; R4 is also folded (but more complicated) and affects turonian to senonian limestones. Based on our field invistigations and modelisations done on impact craters into thick sedimentary rocks [3], we concluded that Tin Bider is consistent with a complex crater with: 1) a central pick (R0, R1, R2), 2) an inner ring (R3), and 3) an outer ring (R4). In order to detect metamorphism shock effects, we analyzed samples coming from the albian sandstones of the central pick, breccias 1 and breccias 2 recovered from the crater floor.

Shock effects in albian sandstones of the central pick: they include fracturing, ondulatory extinction, mosaicism (which are not diagnostic of shock when not associated to other diagnostic shock effects), PFs, PDFs and toasted quartz. We defined two sets of PFs oriented parallel to $\{1013\}$, generally decorated, and to (0001) which is non-decorated set (Brazil twins parallel to (0001) have mechanical character). PDFs are parallel to $\{1012\}, \{1122\}, \{5161\}, \{1010\}$ to $\{1011\}, \{2131\}, \{1121\}$, they are almost decorated and their distinction is very difficult. Toasted quartz is also observed in the samples, it is believed to be a post-shock feature, either resulting from the exsolution of water from glass (primaly along PDFs), or formed by vesiculation after pressure release, at high post-shock temperature and thus, represents the beginning of quartz breakdown due to heating.

Albian sandstones of the central pick are shocked to class 3a (P= 10-20, T=1000) according to [3] and [4]. Related porosity shock effects are not investigated because “spawn” samples of sandstones not implicated on the impact event are not recovered (they are at 500m deep). Jigsaw texture is defined but it is not used for establishing shock stages.

Shock effects on Breccia 1: fracturing, ondulatory extinction and shearing affect quartz grains already showing mosaicism,PFs and PDFs; some grains are characterized by PFs associated with FFs. In addition, shock effects of low stage including inclined lamellae, selective deformation, partial isotropization and complete isotropization of twins are defined on feldspars. Breccias 1 show “two shock phases”; the first one is characterized by shock effects of relatively high pressure (PDFs, mosaicism and the formation of feldspars); the second one is less intense, testified by PFs, FFs and structural changes on feldspars. This second phase presents a shear that can be du to deviatoric pressure that took place some instants, far from the impact point after the principal shock [5].

Shock effects on Breccias 2 show clasts shocked to several stages and it doesn’t show two shock phases. This indicates that they are not formed during the impact event.

References: [1] Lambert P. et al. 1980. *Meteoritics,vol 16, N°3.* [2] Belhai D. et al. 2006. *Bulletin du Service Géologique de 1 ‘Algérie. Vol. 1* 7*, n2, p. 95-112.* [3] Kieffer S. 1971. *Journal of Geophysical Research. Vol. 76, N23, p. 5449- 5473.* [4] Osinski G. R. 2007. *Meteoritics & Planetary Science* 42, Nr 11, 1945–1960. [5] Poelchau M. H. and Kenkmann T. 2011. *Journal of Geophysical Research, vol. 116, b02201.*