

GEOLOGICAL CHARACTERIZATION OF THE AGOUDAL IMPACT STRUCTURE (IMILCHIL DISTRICT, CENTRAL HIGH ATLAS, MOROCCO).

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The Agoudal impact structure (Imilchil district, Central High Atlas, Morocco) does not show any circular shape and is highly eroded. Therefore, its size and the existence of related petro-structural features are largely debated [1,2]. The observations were interpreted within the framework of one or several small impact craters (down to 10 m in diameter), supported by numerical models [2], to a single impact structure [1]. In the absence of an ubiquitous circular signature, the size may be only constrained by indirect arguments. For instance, the spatial distribution of shatter cones suggests a minimum diameter of 1 km [1, 3].

Agoudal shatter cones in situ are exposed in 13 locations. They are restricted to the disturbed central area, and are concentrated in a region of 600 x 400 m. They are aligned in a NE-SW direction, straddling the eastern boundary of the Agoudal meteorite strewn field [1]. They occur in a dark gray shale of marl to marly limestone of Tassent formation, of the Aalenian to the Lower Bajocian age [4,5].

We report on a breccia that is formed mostly of angular and sharp clasts. It is restricted to the shatter cone locations and is observed in some locations filling the fractures of the limestone strata. Furthermore, we have observed a massive breccia outcrop, apparently deep, overlying by the Soltanian deposits in one outcrop in the limit SW of the disturbed area. This breccia may be considered as a result of erosion, and cementation processes whose formation is clearly post-Jurassic and postdates shatter cone formation based on the absence of detected shock metamorphic effects, or phases (such as impact melt) by our team [1].

Additional constraints on the impact structure center and diameter are obtained from detailed structural mapping. We report here measurements of strike and dip directions of the strata, faults and joints as well as the lithology of the strata over an area of ~1500 m x 1500 m, surrounding and including the shatter cones outcrops. The data were plotted using CorelDraw software to perform the first detailed geological map of the Agoudal area. The mapped area is dominated by a Jurassic (Aalenian-Lower Bajocian) marly limestone formations, forming sub-horizontal layers up to 20° dips and a variety of strike orientations. These layers are affected by faults and fractures related to the Atlas deformation with preferred directions of N60 to N120, and N-S. In the northeast of the main hill, vertical to overturned layers trending N150-N160 were observed. A vertical layer was also observed on the flank of the central hill within the area of occurrence of shatter cones. They are not related to the major Atlas deformation, and, in the absence of other tectonic origins, the vertical layer are interpreted as tilted blocks during the excavation or collapse phase of the impact cratering process. The hill area shows also fracturing that is different from the one related to the Atlasic shortening. The stratification seems to be totally chaotic, without specific preferred direction (NS; NW-SE; and WNW-ESE). This disturbance may be related to the impact event in the Agoudal area.

In the case of a simple crater, the vertical to overturned strata could correspond to a remnant of a crater rim. For a complex crater, the structural features and area of shatter cone occurrence may be the relict of a central uplift. Since the presence of shatter cones in the rim area of a simple crater is unlikely, we favor the second interpretation.

References: [1] Chennaoui Aoudjehane H. et al. 2016. *Meteoritics & Planetary Sciences*. doi: 10.1111/maps.12661. [2] Lorenz et al. 2015. *Meteoritics & Planetary Science* 50, Nr 1, 112–134. [3] El Kerni H. et al. 2016. *Meteoritics & Planetary Sciences* 51 (abstract #6110). [4] Studer M. 1980. *Note et Mémoire du Service géologique du Maroc, N 321*. [5] Ibouh H. 1995. Thesis Dissertation. Cadi Ayyad University of Marrakech-Morocco. (Archive at the BSGF Library, France).