

CONFIRMATION OF THE TALEMZANE STRUCTURE (MAADNA) AS A METEORITIC IMPACT CRATER BY NEW CRITERIA

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Introduction: The Talemzane (Maadna) crater is located in Hassi Delaa (Wilaya of Laghouat, Algeria) at 33 ° 19' N and 004 ° 02' E. Many elements which ascertain the meteoritic impact structure were already presented [1], [2], [3] but some still have doubts about its meteoritic origin [4]. Thus, we present in these work new elements that remove the doubt about the meteorite impact character of this circular structure, but we still list the main elements that support the thesis of the Meteorite Crater.

The Main Known Criteria of the Impact Crater of Talemzane (Maadna):

- a. Morphology and Structure:** The crater of Maadna is a beautiful circular structure, 1750 m in diameter and 55 m of depth. It is hollowed in the Senono-Eocene limestones of the triassic province in Saharan platform.
- b. Tectonics:** An intense and concentrated radial fracturing occurs in the area of the crater yet it stays smaller in the vicinity. These tectonic contrasts sharply with the environment of the Saharan platform, with little or no distortion.
- c. Breccias:** They are abundant inside the crater and most are in place, ie they cover the bottom of the Crater and do not result from erosion. Very often, their structure does not allow to differentiate them from common sedimentary Breccias, but it should be noted that the abundance of these breccias - by moving away from the crater- the amount of breccia decreases. Far from the crater, in common place lithology, breccias are rare or absent. Some of these Breccias were formed in situ, ie without significant relative movement of the elements.

New criteria of impact crater:

- a. Pseudotachylites:** For the first time, we highlight in the Talemzane crater (Maadna) the presence of pseudotachylites. These latter are dark material of more or less vitreous appearance and are systematically located in joints or fractures, that is to say, according to the stratification plan for some or perpendicular to this plane. It is, without discussion possible, a secondary installation. Moreover, they often contain bubbles. The surface of contact with the carbonate is systematically very open. On the contrary, contact with flint may be diffuse. To verify that this is indeed Pseudotachylites make a powder diagram. It is probable that K / AR dating can be performed on these Pseudotachylites.
- b. Debris:** Debris are observed on the inner flanks of the crater, resulting mainly from erosion of the lip of the crater. On the external side, several kilometers of breccia debris are observed. The proportion of pseudotachylites decreases with distance.
- c. Flints:** Carbonates contain frequent siliceous accidents of light or white color. Their surface is sometimes blackened with the same color as pseudotachylites. This blackened layer is sometimes thick with a gradual passage. Some flints obviously have a melted and deformed appearance along with bubbles or holes. This aspect, which may seem common to a flint whose shapes are sometimes irregular, is not. Here, the unaffected flints are fairly regular (outside the crater) whereas the shocked flints can be spectacular with deformation marks.
- d. Melted carbonates:** These observations are possible on macroscopic samples, especially those that are altered and sometimes weathered. We note the presence of bubbles usually small but sometimes centimetric. These bubbles cannot be produced in a sedimentary process. In some samples, there are marks of wrinkling as if the sample had passed into a hyperplastic and deformed domain. The effects of the impact are defined in the polyolithological breccias, forming a layer of 10 to 20 cm under the limestone blocks of the edges of the crater. In addition to the grains of quartz and calcareous fragments, these breccias included round black inclusions of a few millimeters. It is in these latter that we have demonstrated the fusion of limestones, which is recognized as the dominant shock effect in carbonates: 1) Immiscibility between silicates and fused carbonates demonstrated with SEM. 2) Abnormal chemical compositions for molten calcite by comparing it with fresh calcite, not involved in the impact event. Abnormal chemical compositions for silicate glass and very low totals. Following these characteristics, we classified this breccia as a "clastic-impact-melt" in the nomenclature relative to impactites.

Conclusion : Confirmation of the presence of marble in breccias, breccia veins and, above all, pseudotachylites are arguments that definitively remove doubt about the impact crater character of the Talemzane (Maadna) structure.

References: [1]. Lambert P., McHone J. F. Jr., Dietz R. S., Briedj M., and Djender M. (1981) *Meteoritics* 16:203–227. [2] Belhai D., Merle O., Vincent P., Devouard B. and Afalfiz A. (2006) *Bulletin du Service Géologique de l'Algérie* 17:95–112. [3] Sahoui R., Belhai D., and Jambon A. (2016) *Arabian Journal of Geosciences* 9:641. doi: 0.1007/s12517-016-2665-6. [4] Lamali A., Rochette P., Merabet N., Abtout A., Maouche S., Gattacceca J., Ferrière L., Hamoudi M., ASTER Team, Meziane E. H., and Ayache M. (2016) *Meteoritics and Planetary Science* 50:2249–2273.