

TAMDAKHT METEORITE (MOROCCO): AN IMPORTANT FALL WITH A RARE FUSION CRUST.H. Chennaoui Aoudjehane¹, A. Mazurier², A. El Albani², B. Devouard³, P. Rochette³, O. Boudouma⁴, T. Shisseh¹¹Hassan II University of Casablanca, Faculty of Sciences Ain Chock, GAIA Laboratory, km 8 Route d'El Jadida 20150 Casablanca, Morocco Chennaoui.hasnaa@gmail.com, ²IC2MP, UMR7285 CNRS, Université de Poitiers, 86073 Poitiers, France arnaud.mazurier@univ-poitiers.fr, ³ Aix-Marseille Université, CNRS, CEREGE UM34, Aix-en-Provence, France, ⁴ UPMC, 4 Place Jussieu, Paris6, France.

Fusion crust of meteorites is usually a thin inframillimetric to millimetric black layer covering the fresh falls. Their aspect is different from one type of meteorite to the other, they maybe shiny or mat, more or less glassy. Fusion crust are formed during the entry of the meteoroid in the Earth atmosphere, it is formed by the fusion of the rock components du to the very important heating resulting on the friction with the atmosphere that slows this crossing. During this crossing, the heating is so important that the external part of the meteoroid experiment fusion and also vaporization processes that forms the lightening following the meteoroid transit to Earth. Most meteorites collected in the deserts don't have fusion crust, it has been removed by the weathering processes.

Very few studies has been conducted on fusion crusts formation and composition [1, 2, 3]. The first interest on fusion crust on 1967 was to check the relationship between cosmic spherules and fusion crust of iron meteorites and mesosiderite [1]. Then on 1999, an extensive study was performed of the fusion crust of 73 stony meteorites to fixe the nature of meteorite ablation spheres and their relationship with cosmic spherules [2]. In 2009 the fusion crust of two lunar meteorites has been analysed essentially to check it's heteorogeneity and the origin of the vesicles in the fusion crust if they are formed by the volatiles of solar wind trapped on the lunar regolith [3].

Here, we present a study of a fusion crust of a meteorite fall in Morocco: Tamdakht [4]. Tamdakht is an eyewitnessed fall that occurred in the South of Morocco on 20th December 2008 at 22:37 local time. The fireball was seen over more than 200 km from Agadir, Marrakech, the Tichka pass, Ouarzazate and over. Many sonic booms has been heard and the fall has been feeling by the nomads near the fall area. The animals were terrified and tried to escape from the enclosures. After five weeks of searching in the High Atlas Mountains covered by snow, especially in the vicinity of the Tichka pass, the first stone was found far from there by about 50 km, close to the village of Tamdakht. The strewnfield of Tamdakht extended on more than 30 km with a direction N74°. The total mass collected is more than 500 kg, the biggest piece so far was more than 80 kg. Many pieces from a few grammes to many kilograms was found. Tamdakht is classified as an ordinary chondrite H5, S3, W0 [5].

We worked on a sample of fusion crust of Tamdakht probably from the biggest piece of this meteorite. These piece of fusion crust show a very important centimetric thickness, it shows a centimetric globular forms wich turned up to be a small pieces of the meteorite embedded in the thick fusion crust. The specimen shows two faces:

- an external one showing globular forms, smooth with a black color and dark blue color in some places
- an internal one showing a millimetric grains bonded to a granular face that seems was in contact with the original piece of meteorite probably before the fall. We can notice the oxidation of the metal with a small brown areas.

X-ray microtomography of one piece of this sample performed in the IC2MP laboratory, University of Poitiers, France with a EasyTom XL Duo device (RX-solutions) [6], reveals:

- the fusion crust is heterogeneous and the glassy parts are also heterogeneous
- the diversity of the fusion crust on term of vesicles that are of very different size and forms,
- the presence of small pieces of the meteorite with different sizes embedded in the glassy fusion crust including chondrules,
- an important presence of melted metal and sulfides, sometimes filling the vesicles with a globular forms.

SEM images shows a very nice euhedral zoned olivines in the fusion crust and some vesicles filled by sulfides surrounding the metal. EMPA show also a big chemical heterogeneity of the fusion crust of Tamdakht. Magnetic measurements show the coexistence of metal and magnetite.

The fusion crust of Tamdakht meteorite is the first one analysed from a fresh fall and an anomalous rare thick one. It's an interesting sample that may help on the knowledge of process of the fusion crust formation and variability on meteorites during their entry in Earth atmosphere and will contribute to the understanding of the relationship between meteoroids and cosmic spherules.

References: [1] El Goresy A. and Fechtig H. 1967. *Smithsonian Contributions to Astrophysics*, Vol. 11, p.391. [2] Genge M. J. and Grady M. M. 1999. *Meteoritics & Planetary Science* 34, 341-356. [3] Thaisen K. G. and Taylor L. A. 2009. *Meteoritics & Planetary Science* 44, Nr6:871-878. [4] Weisberg et al. 2009. *Meteoritics & Planetary Science* 44, Nr 3, 1-33. [5] Chennaoui Aoudjehane et al. 2009. *Meteoritics & Planetary Science* 44, Nr S7:A50. [6] <http://ic2mp.labo.univ-poitiers.fr/index.php/plate-formes/caracterisation-de-materiaux/microtomographie-de-rayons-x/>