FUSION CRUSTS OF RECENT MOROCCAN FALLS: TOWARDS THE IDENTIFICATION OF ABLATION SPHERULES AMONG COSMIC SPHERULES.

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Introduction: The earth intercepts more than 30’000 tons of extraterrestrial material every year [1]. Most of this consists of interplanetary dust produced by collision and evaporation of rocky and icy bodies in the solar system. A fraction of this dust is collected on the surface of the Earth in the form of microscopic particles (typically< 2 mm) termed Micrometeorites (MMs). They range from unmelted particles that retain most of their original mineralogy to totally melted cosmic spherules (CSs). The accumulation of micrometeorites on Earth is an important process in the history of Earth formation. Understanding their origins and formation mechanisms is fundamental.

Fusion Crusts form in all meteorites during their passage through the atmosphere. Their thickness, color brightness, and composition is closly related to the meteorite class as well as the parent size of the meteoroid, his velocity and angle of entry in Earth atmosphere. In this work, we aim to explore the relationship between the micrometeorites and meteorites fusion crusts, focusing on recent ordinary chondrite falls in Morocco.

Methods: We performed mineralogical and petrographic analysis of fusion crusts of some recent Moroccan ordinary chondrite falls, in order to establish criteria to understand the fusion crusts formation process, taking account the difference in fusion crust characteristics from the front and rear in the case of oriented meteorites. Selected meteorites include: Tamdakht which is one of the main focus of our research, Tinajdad, Benguerir, Mahbas Arraid and Sidi Ali ou Azza. Meteorites fusion crusts and One hundred Cosmic spherules where studied by “optical microscope, SEM, EMPA and µRaman comparing their texture, compositions and the mineralogy. Cosmic spherules are from the Transantarctic Mountains micrometeorite collection [2].

Results: There is a large difference between the fusion crust of Tamdakht and other samples, especially concerning the thickness, which is very important in some areas and may be millimetric in Tamdakht, whereas, it is less than one millimeter for other samples [3]. They contain vesicles, their size is also larger in Tamdakht compared to the other samples. We also show the presence of layers and the limit of fusion crust with the meteorite. In Tamdakht we can distinguish clear boundaries between three layers. In Tinajdad sample it’s very difficult to determine the limit between the melting crust and the meteorite. Concerning the mineralogical composition, most fusion crusts are heterogeneous and consist mainly on melted substrate elements losing volatile elements and converting metal to magnetite, except Tamdakht fusion crust that shows an important iron oxide layer, comparing to other samples.

Cosmic spherules show considerable diversity in texture, composition and mineralogy and are sub-divided into several chemical and textural groups. The basic chemical types of CSs, which are also reflected in their mineralogy, are the iron-rich spherules (I-type), a glass with magnetite (G-type) group and silicate-type (S-type) [4,5].

Conclusion: According to our studies on ordinary chondrites and cosmic spherules, we have found that there is a similarity at the textural and chemical composition level. For example, the outermost layer of the Tamdakht melting crust, which consists of magnetite and or wustite, has the same composition and texture found in the cosmic spherules (type I) which are dominated by Fe oxides, magnetite and wustite [5], also data from melted crust suggest that meteorite ablation spheres have similar compositions to silicate dominated cosmic spherules [6]. There are even several similarities between the various layers of fusion crusts and other types of cosmic spherules. In order to investigate further relationships between the cosmic spherules and the fusion crusts of meteorites, we will extend our work the fusion crusts of achondrites.

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