

Every year from 15,000 to 50,000 tons of extraterrestrial matter drop into the Earth's surface. It is cosmic dust - remnants of comets, which when traveling through the universe leave behind a trail of sublime material, as well as larger particles of matter derived from the collision of bodies in the universe. Asteroid collisions cause detachment of the part of the material from their surfaces forming meteoroids. Meteoroids can fall on the surface of planets and form impact craters causing the planet's mass ejection into space. The matter of the planets, meteoroids and cosmic dust reach the Earth constantly. Before they enter the Earth's atmosphere they have high speed of about 20 km/s. The friction between the matter and the air molecules produces very high temperature. The top layer of large-sized meteoroid melts, the matter of small size is completely melted during the entry through the atmosphere. Light phenomenon observed during this process is called meteors. Completely melted part of cosmic matter enrich the Earth's atmosphere with a large amount of gas. Part of cosmic matter, which managed to reach the Earth's surface is called, depending on their size, meteorites or micrometeorites (less than 2 mm in diameter) - they are a huge source of knowledge about other objects in the Solar System and the evolution of the atmosphere of our planet.

The aim of the project is to examine the structure of meteorites, in particular fusion crust formed during the melting process in the atmosphere. By means of observation of the meteorites on hi-resolution image we will see the areas where the most characteristic elements of the crust – vesicles are. Examination of the elemental composition and correlation between individual chemical composition and occurrence of characteristic elements of the fusion crust will evolve our hypothesis of how does the process of melting space matter in the atmosphere occur. To check if the hypothesis is true computer analysis of the phenomenon and experimental studies will be conducted. The experiment will consist in simulation of the conditions during the entry of the cosmic matter into the Earth's atmosphere and in observation of the changes in the structure and chemical composition of the meteorite. Gases emitted by the heated material during the melting process will also be investigated. Research will be carried out in three complementary stages, it will allow to understand the process of melting space matter in the atmosphere. This process causes melting of the entire structure of the micrometeorites and knowledge of this phenomenon is necessary to discover the origin of the micrometeorites.

The subject of the project was chosen due to a combination of my space sciences PhD studies carried out at the Space Research Center, PAS, as well as instrumental analysis acquired at the Faculty of Chemistry at the Warsaw University of Technology. The choice of the topic of the project is due to the desire to study the elemental composition of objects of the solar system, however, direct research (in situ) of these objects is highly expensive and complex. Cosmic materials reaching the Earth's surface are widespread and its analysis can be performed in many laboratories around the world. A very important limitation is lack of proper methods of interpretation of the results of studies of meteorites and micrometeorites because of the unrecognized mechanism of a redistribution of elements during melting in the atmosphere. This project will contribute to improve the methods of interpretation of this mechanism.