Abstract

The diploma thesis refers to the results of laboratory research dedicated to the influence of extraterestrial matter impacts onto a possible prebiotic synthesis on early Mars. The influence of understanding of early Mars chemistry for proceeding studies of terrestrian chemical habitus evolution and origin of life is discussed, as well as certain advantages to be made of this research within exoplanetary science. The prebiotic synthesis scenario purposed connects the hypothesis comprising a key role of extraplanetary bodies impacts played in the chemical evolution of an early Earth-like planet to the important processes studied within chemical evolution of life. Asteroid impacts are simulated by laser sparks, while post-impact thermochemical processes are mimetized in the laboratory by a controlled termolysis of certain key species in presence of meteorites, iron-rich clays and several other minerals and rocks presumably present in real impact craters. This particular field of research carried is likely to have an interesting application within current and future investigations of the Gale crater. Impactor mineraly is described on a particular example of a rare Porangaba meteorite, which, thanks to this research, has recently been addressed as a member of unique (comprising 32 bodies) family tree meteorites group. Porangaba meteorite was found to be an ordinary iron-rich L chondrite, as we refer to in an original research article. Therefore, it belongs to a typical group of meteorites likely to undergo slow water alteration to produce iron-rich smectites, an interesting catalytic activity of which has been unravelled during the thermolytic experiments simulating the behaviour of a prebiotic precursor formamide upon exposure to certain thermal and hydrothermal post-impact processes. Experimental simulations on the impact-driven transformations of model volcanic atmospheres allowed to identidfy OCS and CS_2 as two main products of related chemistry while a later investigation on their chemical stability on several surface environments indicated on an OCS conversion yielding CO_2 and CS_2 to occur. Pilot experiments dedicated to the proceeding prebiotic synthesis shed light on a plausible introduction of sulphur atoms into biomolecules precursors in the form of a non-canonic nucleic acid base 6-mercaptopurine. Last but not least, an influence of modern spectroscopic studies of exoplanets on current prebiotic chemistry research is also discussed in the thesis.

Keywords

impacts, late heavy bombardment, meteorites, clays, prebiotic synthesis, origin of life, exoplanets, spectroscopy