Chemical evolution from the interstellar medium to the solar system: Insight from the analysis of asteroidal materials

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More than 180 interstellar molecules have been identified by radio telescopes, and recently, the presence of interstellar molecules having more than 10 atoms such as glycolamide ($NH_2C(O)CH_2OH$) and propanol (C_3H_7OH) has often been reported in literature [1,2]. Although the presence of further complex interstellar molecules may be detected in future astronomical observations, it is still widely accepted that interstellar molecules have much less complex structures compared to molecules in the solar system. Since all materials present in the solar system should have their ultimate origin in the interstellar medium (ISM) where it was born, it is straightforward to consider that the relatively simple interstellar molecules should have become more complex through the evolution from the ISM to the solar system.

Organic molecules in carbonaceous meteorites have been regarded as a good target for understanding the "end member" of chemical evolution in space since they are the most pristine solar system materials that can be analyzed in the laboratory. Moreover, the recent great successes in the recovery of materials from carbonaceous asteroids Ryugu and Bennu should provide researchers precious opportunities to analyze the most primordial solar system materials without terrestrial contamination [3,4].

The initial analysis of the Ryugu samples detected various kinds of organic molecules such as amino acids and nucleobase, which provides strong evidence for the presence of such biologically relevant molecules in extraterrestrial environments [5,6]. In this talk, I would like to show further findings on the organic contents in the samples recovered from Ryugu. In addition, several potential pathways for the formation of organic molecules in asteroids/meteorites will be discussed based on the distribution of organics in those materials and laboratory experiments.

References

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