Glycine in 67P/ Churyumov Gerasimenko: assessments about its abundance and origin

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Comets play a major role in the study of the physico-chemical processes that took place in our early Solar System. Moreover, they could have brought organic compounds to the primitive Earth that contributed to the chemical evolution that lead to the origin of life on Earth [1]. Thanks to groundbased observations and space missions, it is possible to measure the composition of these small bodies. Although most of the gaseous molecules detected in cometary atmospheres are produced from the sublimation of nucleus ices, other sources have to be taken into account, such as distributed sources, which provide further insight about the composition of the nucleus.

Glycine, the simplest amino acid, has detected in the atmosphere of comet 67P/Churyumov-Gerasimenko by the instrument ROSINA (Rosetta Orbiter Spectrometer Ion and Neutral Analysis) aboard the Rosetta probe. Its density presents a particular profile as a function of the distance from the nucleus [2]. In order to interpret these observations, a numerical model has been developed to calculate the abundance of glycine in the atmosphere of the comet 67P as a function of the distance from the nucleus, and derive its initial abundance in the nucleus. Three cases have been considered: (i) glycine emitted directly and only from the nucleus, (ii) glycine emitted from the sublimation of solid glycine on the particles ejected from the nucleus and (iii) glycine embedded in water ice and emitted from the sublimation of this ice from the particles ejected from the nucleus. The last two cases are called distributed source.

Our results show that a unique source from the nucleus does not explain the profile of density measured by ROSINA. The best fit to the observations corresponds to a distributed source of glycine embedded in sublimating water ice from dust particles. We will discuss the abundance of glycine in these dust particles resulting from this modelling, and consequences on the chemical mechanisms that could have led to its formation in the cometary ices.

1. Orò, J. and C.B. Cosmovici. *Comets and life on the primitive Earth*. in *International Astronomical Union Colloquium*. 1997. Cambridge University Press.

2. Altwegg, K., et al., *Prebiotic chemicals—amino acid and phosphorus—in the coma of comet 67P/Churyumov-Gerasimenko.* Science advances, 2016. **2**(5): p. e1600285.