Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SCG16-12 Room:201A Time:May 28 17:00-17:30

Origin of carbon and other volatile elements on Earth in the light of the Rosetta cometary mission

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The origin of carbon, water, nitrogen and noble gases on Earth is debated between several cosmochemical sources including the protosolar nebula, and volatile-rich bodies such as ”wet” asteroids (up to 15 % equivalent water and a few % C) or comets (up to 50 % water ice). Terrestrial noble gases have been interpreted as originating from the solar nebula or from the solar wind. However, the H and N stable isotope compositions of the atmosphere and the oceans are consistent with an asteroidal, rather than solar or cometary, contribution. For the latter, this inference is based on D and 15N enrichments in comets. However, this view was recently challenged by the discovery of a Jupiter Family comet (JFC) having a ocean-like D/H ratio. The ESA Rosetta mission is presently analyzing the morphology, the physical parameters, and the composition of Comet 67P/Churiumov-Gerasimenko (67P/CG). On board of the spaceraft, the Rosina instrument (PI. K. Altwegg, Univ. Bern, Switzerland) consisting of double focusing and time of flight mass spectrometers is analyzing gases relased by the comet [1, 2]. The analysis of noble gases, stable isotopes, and volatile elements sheds constraints on the formation environment of this body, and seem to indicate a limited, but not necessarily negligible, contribution of 67P/CG-type material to the Earth’s oceans and atmosphere and organics. In particular, the high Ar content of the comet and its implication for terrestrial noble gases will be discussed at the meeting.

[1] Altwegg et al., (2015), Science 347, 126952-1; [2] Hassig et al., (2015); Science 347, aaa0276-1

Keywords: carbon, volatile elements, Comet67P/CG, Rosina