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

PCG30-16 Room:A02 Time:May 27 09:00-09:15

Formation of carbon-rich grains of the Chelyabinsk and Nio meteoritic showers.

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Introduction: Carbon-rich sources of carbon-bearing materials are so many changed in cosmic space from carbon-star formation to any celestial bodies, where main dynamic process is considered to be collision impact process with celestial bodies to planets (including Earth). Recently we have pointed out recently that many carbon-rich grains can be obtained at collision explosions in terrestrial atmosphere by meteorite showers of the Nio and Chelyabinsk meteorites[1-4]. The purpose of the present paper is to elucidate the formation of carbon-rich grains formed by meteoritic showers in air as new carbon-rich source.

Carbon-rich grains of the Nio meteorite: The Nio meteorite (H3-4) fallen at Niho to Miyano, Yamaguchi, Japan (night on 8th August, 1897AD) shows meteoritic shower exploded above ground, where we have collected many fragments of 1,212 spherules and ca.36 pieces with my laboratory students on the old rice-fields at the Niho- to Miyano-towns separately[2] as follows. 1) Japanese rice-paddy with many soil-layers can be stored fallen meteoritic fragments which we can still collect in the grounds of 4 to 5 concentration sites, though the reported fragments of the meteorites are 2 to 3 pieces. 2) Carbon-rich grains can be obtained as FeC in compositions at xenoliths-like materials in the spherules.

Carbon-rich grains of the Chelyabinsk meteorite: The Chelyabinsk meteorite (LL5) fallen recently (15th February, 2013) showed meteoritic shower which have been collected many fragments of ca. 400 pieces on the fields (ca. 3.5kg in total). The samples in this study are collected at Deputaskiy, Russia (Nos.CH-19 to 21) and falllen field (sample No.CH-50 similar to No.CH-20)[5-6] as follows. 1) Sample No. CH-19 shows iron-rich sulfides, carbides and isolated carbon-bearing grains, where irregular void- rich textures shows larger evaporating process in local sites. This indicates that meteorite shower produces carbon-rich grain[4]. 2) Sample No. CH-20 shows primordial chondritic composition with considerable carbon contents. 3) Sample No. CH-21 shows SiC in composition. This indicates that meteorite shower produces single grains of moissanite SiC[2]. 4) All exploded fragments in air contain significant carbon contents with the analytical FE-SEM (JEOL) instrument. Carbon-separation to show the most carbon-rich grains (>80%C) are obtained at the completely mixed sample (No.CH-19)[2].

Carbon concentration sites: Terrestrial carbon sources are considered to be complicated from the deep interior to shallow surface in active planet Earth, though there are no consideration on sources of meteoritic asteroids concentrated on meteoritic shower explosions in air (not from terrestrial rocks). The present results are considered to be new carbon- concentrated source within terrestrial air by meteoritic shower process, which might be clues also for carbon materials on the air planet of the Solar System [2, 3].

Summary: 1) Carbon separation and concentration process can be found at explosions of meteorite shower in air of the Chelyabinsk (Russia) and Nio (Japan) meteorites[4]. 2) The present results suggest that two meteorite shower produce carbon-rich FeS and moissanite SiC grains which were considered to be originated from the comet and/or previous sediments of impact sites[2]. 3) Carbon concentration process by explosions of meteoritic is considered to be new site and sources between extra-terrestrial and terrestrial locations. 4) The present result can be explained new carbon source of impact-related sites (without any remained craters or meteorites).

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Keywords: Russian meteorite shower, Niho meteorite shower, Carbon-rich grains, Air explosion, Extraterrestrial source, SiC