Impact-induced Winter Caused by Sulfuric Acid Aerosol Made from the K/Pg Bolide

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The Cretaceous–Paleogene (K–Pg) mass extinction was triggered by a meteorite impact [e.g., 1, 2]. However, the killing mechanism of the mass extinction are still controversy. Impact-induced winter is one of the most well-known hypotheses of the environmental perturbation caused by the impact. The candidates of winter-causing aerosols, i.e., impact-induced rocky dust and sulfuric acid aerosol, however, have been thought to fall down rapidly. The impact-induced rocky dust are too large to stay in the atmosphere for a long period of time [3]. And also, Ohno et al.[4] show that SO_3 was the dominant species in sulfate-composition impact vapor clouds from the bedrock of the K/Pg impact site and that the residence time of the sulfuric acid aerosol in the atmosphere was too short to cause impact-induced winter. Nevertheless, there was another source of impact-induced sulfur-bearing gases: the carbonaceous chondritic impactor. The estimated mass of sulfur-bearing gases released from the carbonaceous chondritic impactor would have been large enough to cause strong climate forcing.

In the presentation, we show the results of hypervelocity impact experiments using Murchison meteorites and a model calculation of the K/Pg environmental pertuebation. We analyzed the chemical composition of the impact-induced vapor directly using a high-power laser gun in Osaka University and a quadrupole mass spectrometer (QMS) [4] in order to estimate the chemical composition of the sulfur-bearing gas released from the K/Pg bolide. We also estimated the duration of the impact-induced winter caused by sulfuric acid aerosol using a box model . The result shows the impact-induced winter caused by the sulfuric acid aerosol made from the vaporized K/Pg impactor could have lasted for decades.

References: [1] Alvarez et al. (1980) *Science,* 208, 1095. [2] Schulte et al. (2010) *Science,* 327, 1214. [3] Pope (2002) *Geology* 30, 2, 99-102. [4] Ohno et al. (2014) *Nature Geoscience* 7, 279-282.