

Imaging Measurement of Murchison Meteorite by using Stigmatic Imaging Mass Spectrometer

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The Murchison Meteorite have been intensively studied for their prebiotic organic compounds. The elemental composition of this meteorite, including amino acids, hydrocarbons, carboxylic acids, alcohols and ketones, has been investigated by combination of Gas or Liquid chromatography and mass spectrometry analysis. In the next step, the spatial distribution of these organic compounds in Meteorite becomes concerned information. For surface analysis of these meteorite, Secondary Ion Mass Spectrometry (SIMS) or Raman imaging were used conventionally. However, the detailed molecular composition of organic matter is difficult to be identified by these observation technique, for example fragmentation of molecules occurs in SIMS. Thus, we use Matrix Assisted Laser Desorption/Ionization (MALDI) method for soft ionization of organic matter in The Murchison Meteorite. Recently, scanning type imaging mass spectrometry (IMS) with MALDI is intensively used for biomolecular analysis. However, the spatial resolution of scanning MALDI-IMS is limited by the laser focus diameter to about 10 - 100 μm , Therefore, we are developing a stigmatic MALDI imaging mass spectrometer, in which spatial resolution can be achieved to be 1 μm , high enough for observation of Murchison Meteorite. The experimental apparatus for stigmatic imaging consists of MALDI ion source, a multi-turn time-of-flight mass spectrometer (MULTUM) and a time and position sensitive delay line detector. Ion distributions at the sample plate are magnified and projected with the ion optical lens system onto the detector. MULTUM which has four toroidal sector electric fields constitute a figure-eight trajectory is inserted into this system for extending ion flight path. We applied this new apparatus to imaging observation of Murchison Meteorite, and the detailed results of this experiment will be reported in the conference.

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