

## Development of sub-micron U-Pb dating method using MULTUM-SNMS(MULTi-TURn time of flight Mass Spectrometer - Second Neutral Mass Spectrometry)

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SIMS (Secondary Ion Mass Spectrometer) is a powerful tool for Earth and Planetary Science, because it has high-spatial resolution, high-sensitivity, and high-mass resolution. Especially, in-situ U-Pb dating of U-bearing accessory minerals like zircon and/or apatite have provide us the crucial information to decipher the origin and evolution of Earth and Planetary system. In general, it is known that a weak point of conventional SIMS is the low secondary ion yield of sputtered atoms by primary ion beam (less than 1 %). If we can achieve to ionize the sputtered atoms 100%, sensitivity would be 100 times higher and/or we can reduce the beam size by one-tenth with same analytical precision.

So far, we have been developing MULTUM-SNMS (MULTi-TURn time of flight Mass Spectrometer - Second Neutral Mass Spectrometry), using the laser-induced post ionization SIMS system. For primary beam ion source, we adopt the Ga ion gun for a FIB system (SMI3050, SII Nano Technology Inc.) instead of oxygen ion beam, because the spatial resolution of Ga ion beam is much smaller than those of Cs+ and/or O-beam (we can reduce the beam diameter down to 40 nm). Although secondary ion yield by Ga ion beam is extremely low (less than 0.01%), sputtered “neutral” particles are ionized by high-intensity femto-second laser (Solstice, Spectra Physics Inc.: 40 femto-second, 3.5 mJ/pulse). As a result, we attained that a signal intensity (number of finally ionized particle by fem-second laser) goes up 20000 times higher depending on power density of laser. At the conference, we will report on the principle of our next-generation SIMS and recent trials of Pb-Pb dating of terrestrial zircons.

Keywords: post ionization SNMS, sub-micron U-Pb dating method, chronology of Earth and Planetary system