



Major Elements Abundances in Chang'E-3 Landing Site from Active Particle-induced X-ray Spectrometer

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Chang'E-3, China's first Moon lander and rover mission, was launched at 17:30 on 1st December 2013 (UTC) and successfully landed on Moon surface at 13:11 on 14th December 2013 (UTC). About 8 hours later after the soft landing, the rover, named "Yutu" after a mythological rabbit that lives on the Moon as a pet of the Moon goddess, was successfully separated from the lander and started its adventure on the Moon. The success of this mission marks the first soft-landing on the Moon since 1976. The landing site is in northern Mare Imbrium (N44.12, W19.51), close to the boundary of two different geologic units and sits on "young" Eratoshenian lava flows which spread several hundreds to thousands of kilometers. The mare basalts in the landing site are believed to be formed from the lava flows ~2.5 billion years ago, which are significantly younger than all of the returned lunar samples, dating from 3.1 to 3.8 billion years ago. This makes the landing site a very interesting place for exploring geochemical characteristics of the young lava flows and lunar evolution in a later stage.

Active Particle-induced X-ray Spectrometer (APXS) is the only payload on the robotic arm of Yutu rover. It was designed to measure the intensities of characteristic fluorescent X-rays produced by interactions of lunar sample with incident X-rays. Major elements abundances of Mg, Al, Si, Ca, Ti, Fe on the lunar surface were expected to be detected after the exploration. On December 24th (UTC), 2013 and January 14th (UTC), 2014, APXS performed 4 successful measurements on lunar soils along Yutu's track. Characteristic peaks of Mg, Al, Si, K, Ca, Ti, Cr, Mn, Fe, Ni, Cu, Sr and Zr could be clearly seen from the measured spectra. A global fit based on minimum chi-square method has been performed to disentangle different components in the measured spectra. These components include $K\alpha$ and/or $K\beta$ peaks of each element, escape peaks, exponential and shelf tail of major peaks and electronic noises, etc. Fundamental parameter method has been used to extract the absolute abundances based on the measured spectra of soil samples and the calibration targets.

Preliminary results show that one measured soil sample contains 10.7 wt. % MgO, 10.5 wt. % Al₂O₃, 42.5 wt. % SiO₂, 0.13 wt. % K₂O, 10.5 wt. % CaO, 4.0 wt. % TiO₂, and 20.7 wt. % FeO. In the Fe-Ti correlation plot, the FeO and TiO₂ concentrations mark a new region that is never discovered in previous in-situ detection of lunar regolith samples. However, it sits well on the trend established from the remote sensing data by gamma ray spectroscopy of Lunar Prospector. Al₂O₃ and magnesium number (0.48) correlation manifests the characteristics of young materials. In summary, chemical elements abundances in the landing site suggest a kind of young mare basalt which appears to have unusual petrological characteristics.