Paper ID: 12448
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Return to the Moon (02)
Goals and Status of Future Lunar Missions (2)

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AGE DETERMINATION ON THE LUNAR SURFACE OF GROUND SAMPLES

Abstract

One of the highest-priority science goals of planetary exploration is elucidating the absolute chronology like internal differentiation processes or the surface evolution by volcanism and by impact cratering. Radiometric dating of the Apollo samples enabled to link impact crater frequency chronology to absolute ages, not only for the moon but also for other terrestrial planets In situ radiometric dating of rocks and coarse-fines at landing sites on the moon could contribute to testing the cataclysm hypothesis, to determination of the age of the South Pole Aitken basin, or to dating very young basalts (1.2Ga) south of the Aristarchus Plateau, which likely mark the end of active volcanism on the Moon. However, to date no autonomous instrument for the in-situ dating of planetary surfaces – though of vital scientific interest – has been developed. Particularly promising seems to be the application of the 40Ar-39Ar dating method, which is one of the most reliable radiometric methods to date impact metamorphosed rocks and thus constrain lunar, asteroidal or terrestrial cratering histories. Dating basalt with the 40Ar-39Ar method generally is even more straightforward. Based on our recent DLR co-funded study, the development of a compact in-situ 40Ar-39Ar dating instrument appears to be feasible. 252Cf (half life 2.6 yr) would serve as a neutron source, while sample collection and transport between the neutron irradiation unit and the analysis unit would be performed robotically. Special attention was given to optimize the configuration of the compact neutron source in order to maximize the neutron flux and to secure its homogeneity at the

irradiation position. In an ongoing extension of activities on own funding between the above mentioned institutions, we are concentrating on the concept development of some major critical sub-units, especially the definition and dimensioning of the radioactive source, and on some central sub-units of the mass spectrometer subsystem. In our focus lies the optimization of the neutron flux and the sensitivity of the mass spectrometer already studied as an integrated part of a Lunar Lander payload Europe presently in preparation for a robotic mission to the Earth Moon. The mission under study called Lunar Lander is aiming for a moon mission to be launched in the year 2018. However, the ESA Lunar Lander 2018 mission is heavily constrained regarding mass; therefore, this instrument is not a candidate payload. We propose to discuss the possibilities to develop and fly such an instrument as a cooperative international project.