Geophysical Research Abstracts
Vol. 14, EGU2012-7608, 2012
EGU General Assembly 2012


# A New K-AR Development For In Situ Geochronology On The Surface Of Mars

D. Devismes (1), P.-Y. Gillot (1), J.-C. Lefevre (2), E. Chassefière (1), and F. Chiavassa (3)

(1) UMR8148 IDES, Université Paris Sud, Orsay, France (damien.devismes@u-psud.fr), (2) UMR 5138 Archéométrie et Archéologie, Université Claude Bernard, Lyon, France, , (3) CNES, Toulouse, France

We present a new analysis system for in situ datation of rocks on Mars based on K-Ar geochronology. It uses simultaneously two instruments already belonging to the payload of Mars Science Laboratory (MSL) to determinate the age of rocks. Our prototype measures the Potassium with Laser Induced Breakdown Spectroscopy (LIBS) like CHEMCAM does while the quadrupole mass spectrometer detects the 40Ar like Quadrupole Mass Spectrometer Sample Analysis on Mars (QMS-SAM) on MSL is able to. The instrumentation method is a combination of LIBS and Laser Ablation-Mass Spectrometry (LAMS) working almost simultaneously on the same evaporated fraction of the ablations holes of a rock sample.
A Nd:YAG laser operating at 266 nm, 14 ns pulse width, 40 mJ maximum pulse energy, 10 Hz repetition rate is employed to ablate a basalt rock target placed in high-vacuum (about 10-9 Torr). The laser beam is directed on to the isolated sample through a focusing lens and a thin glass window. The surface of the sample is at the focus length of the lens and the spot diameter is about 0.6 mm. According to different studies of the CHEMCAM team, LIBS measures the concentration of 39K within a relative prediction error of about 10% on rock samples and less on standard basaltic glass. The error depends mainly to the global heterogeneity of the target. Assuming a constant ratio between 39K and 40K, we study the 39K doublet at 766.49 and 769.90 nm. In order to collect a good signal to noise ratio of argon, we ablate an adapted number of holes of around 0.08mm3 each hole has its mean concentration of 39K evaluated by LIBS. The global mean of the potassium and its error are recorded. The gas released during ablation is spread through an automatic valve into the main high-vacuum line to be filtered by a getter. The argon as a noble gas is not filtered. After a few minutes of purification a valve releases the gas (including 40Ar and 36Ar) to be analyzed by the quadrupole mass spectrometer. The volume is determined combining empirical, statistical and numerical methods. A large survey of the behavior of aphyrics basalts on ablation leads likely to a better estimation of the volume ablated.