Apollo to Artemis: Insights into lunar volatiles through analysis of new samples  
Supervision team: Mahesh Anand and Ian Franchi  
Lead contact: Mahesh.Anand@open.ac.uk

When first returned by the Apollo missions, the lunar samples appeared to be from a barren, dry, environment, but recent advances in analytical capability and understanding of the lunar surface have revised this assessment, and we now realise that the lunar surface contains a wealth of useful volatiles of scientific importance as well as having the potential as a critical resource for future exploration [1].

One of the major challenges with the study of lunar samples is that they were returned to Earth 50 years ago and exposed to various environments in the curation facility since. However, new pristine samples have recently become available through meticulously planned opening of two new core samples from the Apollo 17 mission that have been stored unopened since their return in 1972. Researchers at The Open University are members of a consortium, funded through NASA’s Apollo Next Generation Sample Analysis (ANGSA) Program to systematically examine the Apollo 17 Core Sample Vacuum Container (CSVC) sample 73001 and its double drive tube companion 73002.

Consequently, the availability of pristine lunar samples provides an ideal opportunity to:

- Measure the abundance and isotopic composition of volatiles in apatite, melt inclusions, as well as, the nominally anhydrous minerals, which are more prone to being compromised by terrestrial contamination.
- Constrain the effects of processes (such as cosmic-ray spallation) that could have modified the original isotopic signature of volatiles in lunar samples.
- Identify volatile reservoirs and gain new insights into volatile cycles on the Moon.

The proposed studentship will focus on measurements of volatiles (e.g., H, Cl) in lunar samples, building upon recent work carried out at the Open University [2-3]. In addition, the student would have an opportunity to contribute towards developing new analytical protocol for measuring Li isotopes in specific lunar minerals to derive CRE ages which then can be used to correct the measured D/H ratios in order to ascertain their original H isotopic composition.

The project goals will be accomplished through (a) determination of volatile element contents and their isotopic composition in basaltic clasts from new lunar samples, including those from the recently opened Apollo 17 core, using microbeam analytical techniques; (b) placing these data within the context of lunar geological processes in order to evaluate the origin and inventory of volatiles on the Moon and its potential usefulness as a resource. The studentship will provide an ideal opportunity for the student to prepare themselves for contributing towards the upcoming Artemis Program.

We seek a highly motivated candidate with an interest in cosmochemistry and willingness to participate in developing and applying new analytical protocols for analysis of planetary materials. The successful applicant must be able to work in a dynamic research team consisting of several PhD students, post-doctoral researchers and international collaborators.

References:


Qualifications required: A first class or upper second class Msci degree in Earth Sciences or related discipline. Any previous experience in using micro-analytical instruments such as EPMA or SEM would be an advantage.