Funded PhD project at SUERC, University of Glasgow:

**Development of geochronological tools for dating of supergene minerals: underpinning Mars Sample Return**

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The detection of organic molecules associated with life on Mars is one of the main goals of future life-searching missions such as the ESA-Roscosmos ExoMars and NASA 2020 mission. In June 2018 the MSL Curiosity Team discovered organic molecules containing both carbon and sulphur in ~3.5 billion year mudstones from Gale Crater. It is thought that these rocks were deposited at a time when the crater was warm, wet and apparently habitable. The successful detection of organic molecules on samples from Mars’ surface exposed to ionizing radiation and oxidative conditions suggests that the preservation of organic molecules may not be limited to subsurface environments, and organic biomarkers may be found on the surface if associated with specific minerals, e.g., jarosite. Jarosite (and other sulfates) may incorporate organic molecules during crystallisation and protect them due to the minerals opacity to UV radiation. As such, jarosite is a target in the search for life for both rover-based analyses and future planned sample return.

On Earth, jarosite is *only formed via aqueous alteration of existing rocks* and is intimately linked with wet, oxidising and acidic environments. It may be supergene (**shallow, fine-grained, low-temperature**) or hypogene (**deep, coarse-grained, relatively high-temperature**) and can only persist over geological time in arid to hyperarid conditions because it rapidly decomposes to ferric oxyhydroxides in a wetter environment. Therefore, following jarosite formation, an arid environment must persist for it to be preserved in the geological record. Supergene jarosite formation at Gale Crater (Mars) may be linked to a 2.1 billion year localised fluid event that altered sulphide minerals to jarosite. However, to establish when organic molecules were freely available on the Martian surface to be entrapped within sulfate minerals, we need to know precisely when the jarosite formed. **The dating of jarosite at relatively high precision (ideally < 1% uncertainty) can only be done robustly when samples are returned to Earth,** as evidenced by ongoing MSL Curiosity measurements that have determined the age of low-temperature minerals at Gale Crater as 2.1 ± 0.8 Ga (± 40%, 2-sigma uncertainty). Precise ages for jarosite through stratigraphic sections on Mars would enable us to examine the availability of carbon reservoirs on Mars.

This 42-month funded PhD studentship based at the Scottish Universities Environmental Research Centre **aims to develop analytical 40Ar/39Ar approaches to determining high-precision chronology for jarosite** to underpin future Mars sample return. The project will involve periods of fieldwork in North and South America.

We are seeking a dynamic candidate with strong background in Physics, Engineering or Earth Science. The student must be mathematically competent with experience of working with, or desire to work with programming languages such as Python or Matlab. The project is funded by the UK Space Agency. The Studentship will be based at the Scottish Universities Environmental Research Centre (SUERC) in East Kilbride, Scotland (<http://www.gla.ac.uk/research/az/suerc/>). The student will be a member of the College Science & Engineering, University of Glasgow Graduate School (<https://www.gla.ac.uk/colleges/scienceengineering/graduateschool/>).

To discuss the project please contact Professor Darren Mark (Darren.mark@glasgow.ac.uk).

To apply for the projects follow the instructions found at the link: <https://www.gla.ac.uk/colleges/scienceengineering/graduateschool/postgraduateresearchstudy/howtoapply/>

**Closing date 15th November 2021. The project will start early in 2022.**