Proposed Studentship

Geological processes active on Venus

Supervisor: Prof. Richard Ghail

Project Description

Venus is the only other Earth-sized planet in our Solar System, and arguably geologically active at the present day. Much of our geological knowledge about Venus comes from the 1989-1994 Magellan mission revealing an enigmatic, complex but geologically Earth-like planet. Our existing paradigms about Venus are being transformed by data from the 2006-2014 Venus Express mission, improved global geodynamic models, and a better understanding of the Precambrian Earth, which appears to be a good analogue for Venus. This renewed interest is fuelled by the discovery of Earth-sized exoplanets and has underpinned the recent selection of three new missions to Venus this decade, including EnVision, which was proposed and led by Prof. Ghail.

However, Magellan data remain a largely untapped resource, with the majority of the planet yet to be studied at the full image resolution. Almost any geoscience topic is open to study at Venus but there are three particularly urgent areas of investigation:

- What is origin and fate of the lowland plains – volcanic, tectonic or sedimentary?
- Do the upland "continents" preserve ancient terranes? and
- How significant is the sedimentary cycle on Venus?

Applications in any of these three areas are particularly welcome. Please submit a one or two paragraph outline of your research interest from which to develop a full application.

Research methodology

Magellan radar data at ~150 m resolution will be the primary source for geomorphological mapping, with ancillary topography and radiometry data (both at ~5 km spatial resolution) and Arecibo polarimetric radar data at ~7 km resolution. Additionally, Venus Express infrared emissivity data at ~50 km resolution are available for the southern hemisphere, providing additional information for discriminating surface materials there.
The main tool for geomorphological mapping is ArcGIS Pro; other software (e.g. SNAP) may be used for additional image processing. Training will be provided as required (see below).

Training

In addition to the standard training packages available to all postgraduates, specific training will be provided in the interpretation of radar images (especially Magellan data), ArcGIS Pro and other software. You will automatically join the EnVision Venus research group which includes academics and PhD students at universities across the UK, Canada and the US, with dedicated Teams resources and quarterly meetings (online, or where possible, in person at LPSC in March), giving you access to some of the most experienced Venus geoscientists in the world.

Person specification

Geoscience graduate; knowledge of GIS and/or remote sensing desirable but not required (training provided). Programming skills are not required but ability to script (e.g. python) may be useful.

References

Byrne, P. K., R. C. Ghail, A. M. Celâl Şengör, P. B. James, C. Klimczak, S. C. Solomon. A globally fragmented and mobile lithosphere on Venus. *Proceedings of the National Academy of Sciences*, Jun 2021, 118 (26) e2025919118; doi: https://doi.org/10.1073/pnas.2025919118

Ghail, R.C. Rheological and petrological implications for a stagnant lid regime on Venus. *Planetary and Space Science*, 2015, 113, 2-9, https://doi.org/10.1016/j.pss.2015.02.005

Smrekar, S. E., A. Davaille, A. C. Sotin, Venus interior structure and dynamics. *Space Science Reviews*, 2018, 214, 88, https://doi.org/10.1007/s11214-018-0518-1

Applications should be made via the Royal Holloway Direct website

Please contact the lead supervisor directly for further details at richard.ghail@rhul.ac.uk