Core formation in Terrestrial Planets: Experiments, Digital Image Analysis, and Numerical Modelling combined impact

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Project Description:

Separation of metal from silicates during the early stages of formation of Earth-like planets is still unsolved. Specifically, for smaller planets where no 'magma ocean' existed at any given time (or during the late stage of crystallization of this outer molten magmatic layer) percolation of metal droplets through a framework of solid silicates is believe d to be the most effective mechanism, if non-homogeneous grain size and shape of the matrix is considered (Ghanbanzadeh et al. 2017). Recent findings on the formation of pallasite meteorites seems though to indicate that once mixed together molten metal and solid silicate evolve towards a texturally mature state without separating (Solferino et al. 2015, Solferino and Golabek, 2018).

Aim:
This project aims to utilize a powerful combination of analogue experiments at magmatic conditions, digital image analysis, and numerical modelling to finally decipher the evolution of partially molten silicate-metal systems, bringing together more than 15 years of research output from leading scientists in the field.
The research will tackle the following chief questions:

- How does deformation followed by re-annealing affects interconnectivity of molten metal in silicates?
- Can we use numerical deformation experiments of digitally acquired images of natural samples (pallasite meteorites) and run products (analogue experiments) to reconstruct the history of early differentiation in terrestrial planetesimals?
- Is non-homogeneity of silicate grains in the mantle of forming terrestrial planetesimals really a factor in terms of enhancing the 'contiguity' of metal melt pockets an films in a silicate framework, thus, allowing percolation of molten metal to form a core?

Training:
This project will train postgraduate students in essential scientific & technical skills required in an academic research environment, professional digital-learned jobs, highest level digital image analysis applicable to natural and synthetic materials.

Person specification:
Background in mineralogy or meteorites is required. Strong background in petrology and/or digital image analysis is desirable but not essential.

References:

Ghanbarzadeh, S. Hesse, M.A., and Prodanovic, M. (2017) Percolative core formation in planetesimals enabled by hysteresis in metal connectivity. PNAS, 114, 13406–13411.

Solferino, G.F.D., Golabek, G.J., Nimmo, F., Schmidt, M.W. (2015) Fast grain growth of olivine in liquid Fe–S and the formation of pallasites with rounded olivine grains. Geochim. Cosmochim. Acta, 162, 259–275.

Solferino, G.F.D., and Golabek, G.J. (2018) Olivine grain growth in partially molten Fe-Ni-S: A proxy for the genesis of pallasite meteorites. Earth and Planetary Science Letters, 504, 38-52

Details on how to apply can be found here ***www.rhul.ac.uk/studyhere/postgraduate/applying***
Please contact the Postgraduate Programmes Co-ordinator, if you have additional questions about the department or application procedures (email: ***pgadmin@es.rhul.ac.uk*** *; tel: 01784-443581).*
Applicants are requested to send an additional copy of their CV directly to the lead supervisor of the project in which they are interested. Please also contact the supervisor if you have any questions about the project itself