Europlanet TNA Report

PROJECT LEADER

Name: Natalie Starkey
Address: PSSRI, Robert Hooke Building, The Open University, Walton Hall, MK7 6AA **E-mail: n.starkey@open.ac.uk**

COLLABORATORS

Name:	**Affiliation:**
Ian Franchi	PSSRI, Open University
Jon Hillier	PSSRI, Open University
Date of TNA visit:	22nd March 2010
Host laboratory:	Van de Graaff accelerator facility, Max Planck Institut fuer Kernphysik

Project Title –

Hypervelocity impact experiments on Al foil targets as an analogue for Stardust foil craters: investigating the composition of impact crater residues.

- Report on the outcomes of the TNA visit

We visited the Van de Graaff accelerator laboratory at the Max Planck Institute in Heidelberg in March 2010 to carry out some hypervelocity impact experiments. The aim of the experiments was to simulate the impacts onto aluminium foil that occurred during the Stardust spacecraft encounter with the comet 81P/Wild 2. We were interested in understanding how particles may be altered during impact and particularly if the isotopic composition of the particles was retained. In order to carry out these experiments we needed to produce impacts in as clean an environment as possible and that is why the Van de Graaff was chosen over a light gas gun.

For the intended hypervelocity experiments we provided all of the minerals (olivine, pyroxene and FeS) as metal-coated dust particles (< 3 μm) prepared at PSSRI. In addition we provided the aluminium foil target (Al 1100 series Al foil as used during the Stardust mission). Part of the experiments carried out during our visit involved testing whether the mineral powders that we produced were of a suitable size for the Van de Graaff to be able to fire at the 6.1km/s velocity that was required to simulate the space impacts. Unfortunately it seemed that although our olivine dust was of the correct grain size (i.e. small enough to produce the size of impact on which we were concentrating), we found that the particles clumped together in the test rig so that the Van de Graaff was unable to pick up individual particles. We returned home with the olivine particles in order to prepare another batch to be tested. The coated pyroxene powders, however, did work perfectly and we were able to

fire these particles for a period of 40 minutes to produce hypervelocity impacts on a piece of aluminium foil. Despite the fact that we produced over 200 impacts in this time, on return to the PSSRI lab we found that the density of impacts in any one area was too small and that we would need to repeat the experiment but for a longer period of time to produce the number of impacts that was required. Due to time constraints we were unable to fire the FeS particles during our visit. We are waiting for the current experiments being carried out at the Van de Graaff to be completed in order for the laboratory to continue with our experiment to produce foils containing impacts from olivine, pyroxene and also FeS at 6.1 km/s. We learnt during our visit that we will need the foils to be left in the impact zone of the Van de Graaff for a longer period of time or for the flux of particles reaching the impact zone to be increased in order to produce the higher density of impact craters in a small area. This will be required in order to provide the correct materials to complete the NanoSIMS isotopic work in PSSRI where the foils will be used as analogues, and therefore as standards, for craters in the Stardust flight foils.

The conference abstract below was produced and we plan for a second paper which will concentrate on the Stardust flight foils and will discuss the Heidelberg test foils in the methods section.

Starkey, N.A., Franchi, I.A., Hillier, J.K., Price, M.C., Burchell, M.J., Srama, R., Guillermier, C. Experimental analogue and methodology for the analysis of Stardust cometary dust residue on aluminium foils. Dusty Visions Abstract, Göttingen, 2010.

- Host approval The host is required to approve the report agreeing it is an accurate account of the research performed.
- The report covers and describes the activities performed at MPIK dust accelerator. In addition I would like to emphasize, that target foil handling is critical and lab experimentators are responsible for adequate packing and transportation of samples used in the laboratory in order to ensure a successful surface analysis at their home institution.