Europlanet TNA Report

PROJECT LEADER

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Date of TNA visit:	3-20 December 2012
Host laboratory:	Open University, Planet Simulators B3 Mars Chamber II

Project Title – The interaction of brines with sediments under martian conditions.

- Report on the outcomes of the TNA visit (approx 1 page)

Preparatory work was performed in the HVI lab over 6 days between 6 and 30 November 2012 by SJC. This included testing and setting up of the equipment ready for experiments. SJC and MG performed a suite of experiments between 6 and 20 December inclusive. For all the experiments we used fine sand 5cm thick tilted at an angle of 14° and all experiments were performed under at atmospheric pressure of between 7-10mbar. The liquid was introduced from a reservoir located inside the chamber using a submersed pump, allowing the liquid to equilibrate and exsolve any dissolved gases. It was released vertically from a pipe just above the sediment surface and allowed to run down the sediment for 30s, resulting in a volume of 1.2-1.5l. In every case the water was metastable when released – it always boiled while flowing down the substrate. We used two fluids: (1) deionised water and (2) 25%per weight solution of Magnesium Sulphate. We varied the temperature of the substrate and the liquid (see table). The substrate temperature was lowered with the aid of a liquid nitrogen cooling plate on top of which the sediment tray was placed. The temperature of the sediment was monitored with 6 thermocouples at 2cm depth spaced across the tray and the water reservoir and cooling plate temperatures were also monitored. We recorded the progress of each experiment with two internal webcams and one external video device. After each experiment the test bed was scanned with a laser to obtain the topography of the surface. In experiments where the liquid froze the frozen body was lifted out and the base re-scanned to obtain an estimate of the solid thickness. The set-up time before each run was approximately 2-3hrs, extending to 3-4hrs for substrate temperatures of -25°C and post-experiment scanning and clean-up took approximately 1-2hr.

Table summarising experiments performed:

Sediment temperature °C	Liquid Temperature °C	Liquid	Repeats
20	5	Water	2
20	20	Water	2
-25	5	Water	1
20	5	Brine	1
20	20	Brine	2
-25	5	Brine	1

Work is on-going to complete the suite of experiments, including adding an intermediate concentration brine and repeating the experiments performed at -25°C. A full analysis of the data has not yet been competed, but initial results are that the effective runout of the brine is greater than that of the water at substrate temperature 20°C, and this effect is exaggerated with a substrate at -25°C. Our initial interpretation is that this is caused by a reduced infiltration rate for the brine (which has a slightly higher viscosity), resulting in greater overland flow. This is an important result when considering water flowing on the martian surface under present-day conditions, such as the recently reported Recurring Slope Lineae (RSLs; McEwan, et al., Science, 2012), because much less water would be needed to form a brine-flow than a water-flow with the same dimensions.

Please include:

- Publications arising/planned (include conference abstracts etc)

Conway SJ, Gourronc M and Patel M (2013) Laboratory simulations under martian environmental conditions: water vs. brine flowing over a sloping substrate. European Geosciences Union Congress, Vienna Austria.
Planned: publication in EPSL/Icarus by end 2013.

- Host approval

The host is required to approve the report agreeing it is an accurate account of the research performed.

- Host approval is provided here by Dr M.R. Patel (Open University).