The nature of the surface materials at the Agilkia landing site on 67P

I. P. WRIGHT*, S. SHERIDAN, G. H. MORGAN, D. J. ANDREWS, S. J. BARBER AND A. D. MORSE

Dept. of Physical Sciences, Open Univ., MK7 6AA, UK (*correspondence: ian.wright@open.ac.uk).

Introduction:

The *Philae* Lander (part of the *Rosetta* space mission) made its historic landing on the Jupiter-family comet 67P/Churyumov-Gerasimenko on 12th November, 2014. One of the instruments on board the lander, *Ptolemy*, is a gas chromatograph-mass spectrometer system designed to make elemental and isotopic measurements of the surface of the comet. The ultimate capability of the instrument lies in being able to analyse a solid sample of the surface acquired by drilling (using the SD2 device, which delivers materials to ovens mounted on a carousel). However, it also has other operational modes. So, for instance, it was pre-programmed to start so-called "sniffing" operations a few minutes after touchdown. The intention had been to gather some instant and immediate information on the status of volatiles outgassing from the landing site. In light of the non-optimal circumstances associated with the arrival at the comet's surface, the measurements were actually made whilst in mid-flight during the "first bounce". Nevertheless, the instrument acquired some interesting data.

Results:

Two mass spectra were acquired after the initial touchdown: one from m/z 13-89 and the other from m/z 25-136 (both at unit resolution, and with noise levels that are ≤1 count per second). The data acquired at this time show a rich diversity of organic compounds (which are clearly of cometary origin and nothing to do with any instrument or spacecraft background/outgassing). If we consider the timing of the measurements it is apparent that *Philae* would have been some 100s metres away from the original touchdown site (both laterally and above the surface). As such it seems inconceivable that the data arise from gases/volatiles enetering the instrument at the time the measurments were made. Rather, it would appear that the materials gained ingress to the instrument as solids and were either analysed as such, or as they subsequently de-gassed/volatilised following equilibration to spacecraft temperatures. Regardless of the exact details of sample aquisition, we believe that the data are representative of the chemical composition of the surface of 67P at the first touchdown point (i.e. the region known as Agilkia). Further data, which were obtained from the final landing site (Abydos), help to put the results into context.