Europlanet TNA Report

PROJECT LEADER

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Project Title – Emissivity Infrared spectra of mineral mixtures to investigate the composition of the Phobos surface

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

Based on the first guesses of the linear deconvolution technique, one of the mixture most likely composing the surface of Phobos could be considered that of a phyllosilicate and an olivine (Palomba et al., 2010).

We thus acquired Thermal InfraRed (TIR) spectra in the spectral range from 600 to 1400 cm^{-1} of biotite and fayalite, both pure and in mixture. The mixtures have been fixed at 3 different volume percentages, i.e. 30-70, 50-50 and 70-30, with the last two being the best matches to the TES Phobos spectrum (Fig. 1a).

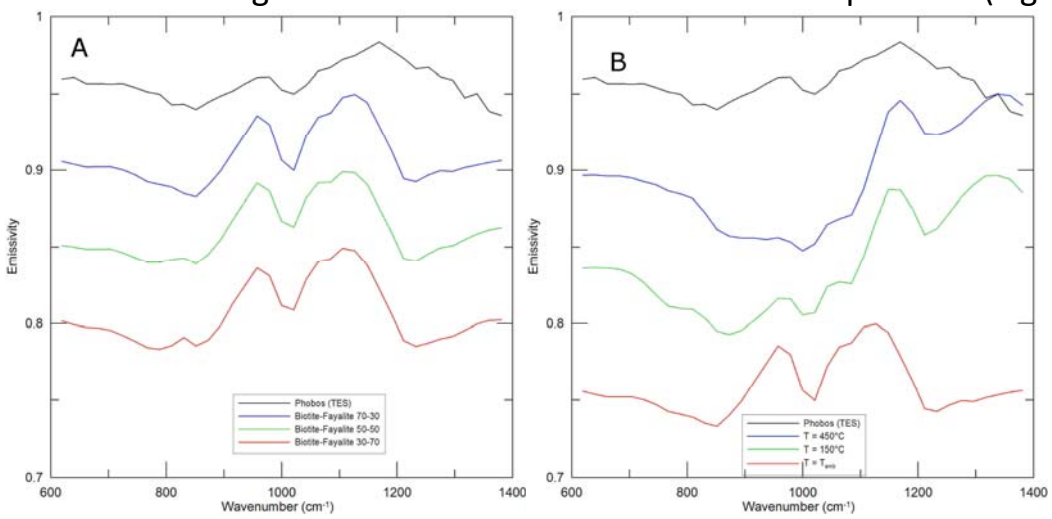

Fig 1a: Comparison of the 3 different Biotite-Fayalite mixtures (from top to bottom: 70/30, 50/50 and 30/70) with the TES spectrum of Phobos. Fig. 1b: Comparison of the 70/30

mixture at different temperatures (from top to bottom T = 450°C, T=150°C and T=Tamb) with the TES spectrum of Phobos. The spectra are vertically shifted for clarity

However Phobos likely experienced large impacts and thermal processing and has no atmosphere. For this reason TIR spectra of non processed samples at ambient conditions might not be representative of those of the surface of Phobos. Therefore the measurements continued by heating the samples and acquiring the corresponding TIR spectra. This work has been done with the 70-30 mixture of biotite and fayalite in the temperature range 150 – 450°C at low pressures (i.e. 2 mb).
Heating the samples should result in a partial dehydration of the phyllosilicate mineral and the low pressure condition could induce some spectral change, such as a diminishing spectral contrast and a wavelength shift of the Christiansen feature.
The effect of low pressure and high temperature is clearly seen in Fig. 1b, where the mixture Biotite 70% - Fayalite 30% is compared at 3 different temperatures (i.e., ambient, 150°C and 450°) with the TES spectrum of Phobos. The main change is the flattening of the spectra shape from 600 to 1100 cm-1 and the shift of the Christiansen feature position, that becomes very close to the Phobos one.
The work done so far is encouraging and more detailed measurements would probably result in a better determination of the composition of the mineralogy of Phobos.

Please include:

- Publications arising/planned (include conference abstracts etc) : Palomba et al., Phobos surface composition: clues from laboratory emissivity measurements and MGS-TES spectral data, EPSC Abstracts, Vol. 5, EPSC2010-442, 2010, European Planetary Science Congress 2010

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