Geophysical Research Abstracts
Vol. 19, EGU2017-7962, 2017
EGU General Assembly 2017

Laboratory experiments on ammoniated clay minerals with relevance for asteroid (1) Ceres

Simone De Angelis (1), Stefania Stefani (1), Maria Cristina De Sanctis (1), Giuseppe Piccioni (1), Eleonora Ammannito (1,2)

(1) INAF-IAPS, Rome, Italy, (2) University of California Los Angeles, Earth Planetary and Space Sciences, Los Angeles, CA-90095, USA

Recent observations with VIR spectrometer onboard Dawn spacecraft [1] have suggested the presence of ammoniated phyllosilicates widespread on the surface of asteroid (1) Ceres [2,3]. The global surface composition of Ceres as suggested by VIR average infrared spectrum in the 1-4 micron range appears to be due to a mixture of NH4-bearing phyllosilicates, serpentine, carbonates and a dark absorbing phase (magnetite or amorphous carbon) [2]. An absorption feature occurring near 3.1 micron in the average spectrum is considered the main evidence for the presence of NH4-bearing phase; nevertheless in the past several authors tried to explain this feature, as observed with telescopic spectra, invoking the presence of brucite, cronstedtite, water ice or clays [4].
In this project we are carrying out laboratory experiments with the aim of studying ammoniated phyllosilicates in the visible-infrared range. A suite of 9 clay minerals has been used for this study, including illite, nontronite and montmorillonite. In order to produce the ammoniated species we followed a modified procedure based on the one described in Bishop et al. (2002) [5]. All minerals were reduced in fine grain size (<36 micron), treated with ammonium hydroxide (NH4OH) and heated in oven at 200°C for 24 h at normal pressure conditions, before the measurements.
Reflectance spectra were acquired with the Fourier Transform Infrared Spectrometer (FTIR) in use at INAF-IAPS/P-LAB, in the range 1-14 [U+F06D]m, on both clay minerals and NH4-treated clays. Almost all spectra of NH4-treated species are characterized by the occurrence of several new absorption features, appearing at different wavelengths near 2, 3, 6 and 7 micron. In some cases the spectral shape of already existent absorption bands resulted deeply modified. A few species did not show the appearance of new features. These results suggest that NH4+ ions fix in various ways in different minerals. Nontronite and montmorillonite appear to be the best candidates, among the studied suite, to be used in future laboratory reproduced analog mixtures.

[1] Russell C.T. et al., 2004, Planetary and Space Science, 52, 465-489
[2] De Sanctis M.C. et al., 2015, Nature, 528, 241-244
[3] Ammannito E. et al., 2016, Science, vol.353, issue 6303
[4] Rivkin A.S. et al., 2011, Space Science Reviews, 163, 95-116
[5] Bishop J.L. et al., 2002, Planetary and Space Science, 50, 11-19