Basaltic asteroids in the main belt: Spectral and mineralogical characterization

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Most of the basaltic asteroids are thought to be fragments of Vesta, forming its dynamical family, but few others do not appear to have a clear dynamical link, suggesting, thus, the existence of other basaltic parent bodies. Excluding Vesta and its family, the lack of intact differentiated asteroids introduces a strong constraint to the formation scenario of basaltic material. The spectral investigation of the basaltic asteroids in the main belt can help in understanding if there are V-type asteroids that show a differing mineralogy with respect to Vesta and its family members. We present new NIR reflectance spectra of V-type candidate asteroids obtained at the 3.6-m Telescopio Nazionale Galileo covering the spectral range 0.7 to 2.5 microns. The observed objects were selected from diverse datasets of putative V-type asteroids in order to characterize them, and hence better understand their relationship with Vesta. All the spectra of the asteroids here reported show two prominent absorption features at 1 and 2 microns that are typical of V-class objects, indicating that the methods based on the photometric surveys to infer the basaltic asteroid distribution are quite robust. The spectra of these asteroids are examined and compared to those of Vesta and the HED meteorites, for which Vesta is believed to be the parent body, and other V-type asteroids previously observed.

To enlarge the data set and increase the statistical significance of the analysis, we included the data presented in our previous articles (De Sanctis et al., 2011ab). It is important to note that all these objects have been observed at the same telescope with the same instrumental set up. We derive spectral parameters from the NIR spectra to infer mineralogical information on the observed asteroids. The V-type asteroids here examined show a large variability of band parameters. These parameters have been compared with those of the HED meteorites and with the parameters derived for Vesta using the Dawn VIR spectral observations (De Sanctis et al., 2012, 2013; Ammannito et al., 2013). The V-type asteroids band centers here reported are mostly compatible with the HED meteorites and with Vesta derived values.

References: Ammannito E., De Sanctis M. C., Capaccioni F., Capria M. T., Carraro F., Combe J.-P., Fonte S., Frigeri A., Joy S. J., Longobardo A., Magni G., Marchi S., McCord T. B., McFadden L. A, McSween H. Y., Palomba E., Pieters C. M., Polanskye C. A., Raymond C. A., Sunshine J. M., Tosi F., Zambon F., and Russell C. T. 2013. Vestan lithologies mapped by the visual and infrared spectrometer on Dawn. Meteoritics and Planetary Science 48:2185–2198, doi:10.1111 maps.12192; De Sanctis M. C., Migliorini A., Luzia Jasmin F., Lazzaro D., Filacchione G., Marchi S., and Ammannito E. 2011 a. Spectral and mineralogical characterization of inner main belt V-type asteroids. Astronomy and Astrophysics 533:A77, doi:10.1051 0004-6361-201117136. De Sanctis M. C., Ammannito E., Migliorini A., Lazzaro D., Capria M. T., and McFadden L. 2011 b. Mineralogical characterization of some V-type asteroids, in support of the NASA Dawn mission. Monthly Notices of the Royal Astronomical Society 412:2318–2332; De Sanctis M. C., Ammannito E., Capria M. T., Tosi F., Capaccioni F., Zambon F., Carraro F., Fonte S., Frigeri A., Jaumann R., Magni G., Marchi S., McCord T. B., McFadden L. A., McSween H. Y., Mittlefehldt D. W., Nathues A., Palomba E., Pieters C. M., Raymond C. A., Russell C. T., Toplis M. J., and Turrini D. 2012 Spectroscopic characterization of mineralogy and its diversity across Vesta. Science 336:697–700, doi:10.1126-science.1219270; De Sanctis M. C., Ammannito E., Capria M. T., Capaccioni F., Combe J. P., Frigeri A., Longobardo A., Magni G., Marchi S., McCord T. B., Palomba E., Tosi F., Zambon F., Carraro F., Fonte S., Li Y. J., McFadden L. A., Mittlefehldt D. W., Pieters C. M., Jaumann R., Stephan K., Raymond C. A., and Russell C. T. 2013. Vesta's mineralogical composition as revealed by the visible and infrared spectrometer-VIR on Dawn. Meteoritics and Planetary Science, doi:10.1111-maps.12138.