EPSC Abstracts
Vol. 6, EPSC-DPS2011-207, 2011
EPSC-DPS Joint Meeting 2011


# Surface mineralogy of two V-type near-Earth asteroids

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## Abstract

We have obtained Near-infrared (0.7-2.5 $\mu$m) spectra of two V-type near-Earth asteroids. The pyroxene mineralogy for each asteroid was calculated using the formulas derived by [1]. We found that the molar contents of ferroslite (Fs) and wollastonite (Wo) for these asteroids are consistent with howardite meteorites or polymict eucrites, suggesting that these objects are formed by mixed ejecta.

## 1. Introduction

Oxygen isotopic measurements [2] of howardites, eucrites and diogenites (HEDs) reveal that almost all of them originated on the same parent body, being asteroid 4 Vesta the most likely source of these meteorites [3]. However, a few eucrites have oxygen isotopic ratios that differ from the other HEDs, implying that they originated in a different parent body or that oxygen isotopes were not homogeneous on Vesta. Because of their proximity, near-Earth asteroids (NEAs) are the most likely source of meteorites found on Earth. Hence, finding links between the spectral properties of these objects and those measured in the laboratory for meteorites is a key component in tracing meteorite origins. In this work we derive the pyroxene mineralogy of two V-type NEAs and compare the results with previous measurements of other V-type NEAs and HEDs meteorites.

### 1.1. Observations/Data Reduction

Near-infrared observations of two NEAs were obtained remotely using the SpeX instrument [4] of NASA's IRTF on Mauna Kea, Hawai'i. Near-Earth asteroid 164121 (2003 YT1) was observed on October 20, 2009, when the object's V-mag was 14.8, and (4055) Magellan was observed on July 21, 2010 when the asteroid was of V-mag 15.9. In addition to the asteroid spectra, standard stars and solar analogs were also observed to correct for telluric and solar continuum, respectively. The data were reduced by using Spextool [5]. Spectral band parameters (band centers and band area ratio/BAR) were calculated using SpecPR [6].

## 2. Mineralogical Analysis

Data of 164121 (2003 YT1) were averaged together (in total 20 spectra) in order to create the final spectrum of the asteroid. This spectrum exhibit two absorption features, the Band I center is located at 0.928±0.01 $\mu$m and the Band II center is at 1.905±0.01 $\mu$m with a BAR of 1.64±0.06. Magellan final spectrum was obtained after averaging 10 spectra. Similarly to the spectrum of the previous asteroid, (4055) Magellan shows well defined 1- and 2- micron features. The Band I center is located at 0.929±0.01 $\mu$m and the Band II center is at 1.92±0.01 $\mu$m with a BAR of 1.94±0.06. After plotting the band centers of these two asteroids on the Band-Band plot from [7] we found that these objects have a surface assemblage dominated by orthopyroxene. From the band center values, and using the equations derived by [1], we calculated the calcium (Wo) and iron (Fs) content for each asteroid. Hence, the pyroxene chemistry for 164121 (2003 YT1) and (4055) Magellan are Fs32En63Wo5 and Fs34En60Wo6 respectively. As seen in Figure 1, these values are consistent with those measured for other V-type NEAs and HED meteorites studied by [8]. Furthermore, the molar content of Wo and Fs for 164121 (2003 YT1) and (4055) Magellan lies in the diogenite-eucrite boundary, suggesting that these objects are probably formed by regolith breccia consisting of eucrite and diogenite fragments.

# 3. Figures

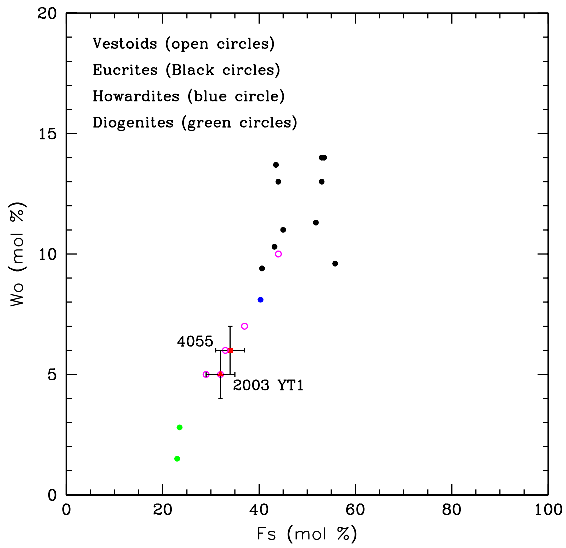


Figure 1: Molar content of (Wo) vs. Molar content of (Fs) for 164121 (2003 YT1) and 4055 Magellan.

# 4. Summary and Conclusions

The two NEAs studied in the present work exhibit the characteristics pyroxene absorption bands typical of HED meteorites. In particular the mineralogical analysis shows a good match with howardites and polymict eucrites, and suggest that they are formed by regolith breccia originated in a larger asteroid that experienced extensive igneous processing, most probably Vesta.

# Acknowledgements


J. A. Sanchez acknowledges a PhD fellowship of the International Max Planck Research School on Physical Processes in the Solar System and Beyond.


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