EPSC Abstracts
Vol. 11, EPSC2017-553, 2017
European Planetary Science Congress 2017

Characterization of basaltic material in the outer Solar System.

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Abstract

The majority of basaltic objects in the main belt are dynamically connected to Vesta, the largest differentiated asteroid known. Others, due to their current orbital parameters, cannot be easily linked to Vesta and could be fragments of another differentiated asteroid. A recent statistical analysis performed by our group pointed out that, while basaltic objects in the inner main belt can be compatible with a Vesta origin, this seems not the case for basaltic asteroids beyond 2.5 a.u.
We present a spectroscopic survey for 25 basaltic candidates in the middle and outer main belt obtained between 2015 and 2016 at TNG and ESO-NTT.

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1. Introduction

In the last decades several main belt asteroids have been found having a basaltic surface composition, similar to those of Vesta and basaltic achondrite meteorites. The discovery of a large basin in the southern hemisphere of Vesta [8,12] seemed to confirm the idea that a collisional event might have ejected basaltic fragments into orbits dynamically linked to Vesta, creating a dynamical family (the so-called *vestoids*).
The identification in the inner main belt of basaltic objects not members of the Vesta family [1,3] raised questions about the existence of other basaltic parent bodies, altough some of these non-Vestoids objects could have escaped from the Vesta family through resonant and/or non-gravitational effects [10].
Furthermore, the discovery of small basaltic objects in the middle-outer main belt not dynamically linked to Vesta [7,9] led to the idea that Vesta could not be the parent body for all the basaltic material in the Solar System, since at the moment there seems to exist no plausible transport mechanism able to convey Vesta's fragments beyond the 3:1 resonance.
Laboratory study on meteorites found that at least five other differentiated asteroids (D > 150-300 km) have existed in the main belt [13]. The lack of other great V-type asteroids discovered seems to suggest that these basaltic parent bodies were battered to bits, or that space weathering altered their spectral features. Finally, a recent review [6] pointed out that, while inner main belt V-types show similarities with Vesta, middle-outer V-types (MOVs) present a different mineralogy respect to the other basaltic material [5].

2. Results

We will present new visible reflectance spectra for 25 V-type MOV candidates obtained between 2015 and 2016 at Telescopio Nazionale Galileo (TNG) and ESO – New Technology Telescope (NTT). The observed objects were selected from different databases of putative V-type asteroids [2,11] and the analysis of their spectral parameters will be put in the context of the recent statistical analysis performed by our group [6]. We will also assess the effects of space weathering on basaltic surfaces at different heliocentric distances using laboratory analogues [4] and spectra characterized in our sample.

Acknowledgements

Part of this work was supported by the NEOShield-2 project (European Commission's Horizon 2020 program, contract No. PROTEC-2-2014-640351).

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