Compositional Study of 51 Nemausa: A Possible Carbonaceous Chondrite-like Asteroid. C. M. Reynolds[1], V. Reddy[1], and M. J. Gaffey[1] [1]Department of Space Studies, Box 9008, University of North Dakota, Grand Forks, North Dakota 58202, chalbeth_reynolds@hotmail.com.

Introduction: 51 Nemausa is a main-belt asteroid located at ~2.4 AU, with an IRAS diameter of ~150km, and a geometric albedo (p_v) of 0.062 [1]. The asteroid has been classified taxonomically as a C-type asteroid with an unusual spectrum by [2] and a Ch-type by [3].

The C-type asteroids, which make up ~50% of the main belt asteroids, have low geometric albedos ($p_v < 0.065$) [4] due to the possible presence of opaque phases on the surface. These asteroids are thought to be the parent bodies of carbonaceous chondrite meteorites. Carbonaceous chondrites, specifically CI1 and CM2 [5], contain hydrated minerals, such as Fe-bearing phyllosilicates, which form at low temperatures [6].

The Ch-type asteroids have a ~0.70-µm absorption feature which suggests a hydrated mineral phase [3], likely by iron-bearing phyllosilicates [7], which have been found in carbonaceous chondrites. Several visible spectroscopic studies of 51 Nemausa have yielded the same ~0.70-µm absorption feature [8,9,10,11] which supports the idea of hydration of the asteroid's surface.

Though there have been several visible-wavelength spectroscopic studies done on 51 Nemausa, only a couple near-IR studies have been conducted to date. One study [12] shows a weak ~0.90-µm absorption feature which might be due to the presence of hydrated minerals [5].

Observations and Data Reduction: 51 Nemausa was remotely observed by V. Reddy on September 21, 2008 using the SpeX near-infrared spectrograph [13] at the NASA Infrared Telescope Facility on Mauna Kea, Hawai'i. The SpeX data was reduced using the Unix-based Image Reduction Analysis Facility and the Windows-based SpecPR spectral processing program [14]. SpecPR was also used to calculate the Band I center and area.

Results: The near-IR spectrum of 51 Nemausa (Fig. 1) shows a very weak (~1-2%) Band I absorption feature with a band center of 0.94-µm ± 0.05-µm (Fig. 2). This correlates with the weak ~0.90-µm features found in the visible spectrum [3] (Fig. 3) and near-IR spectrum [12] of 51 Nemausa. Figure 4 shows the SMASS II visible spectrum normalized to the near-IR spectrum of 51 Nemausa. Both spectra (Figs. 1 and 2) show the ~0.9-µm absorption feature. There are also two additional, weak absorption features near ~1.9-µm and longward of ~2.1-µm which are possibly due to the presence of hydrated minerals.

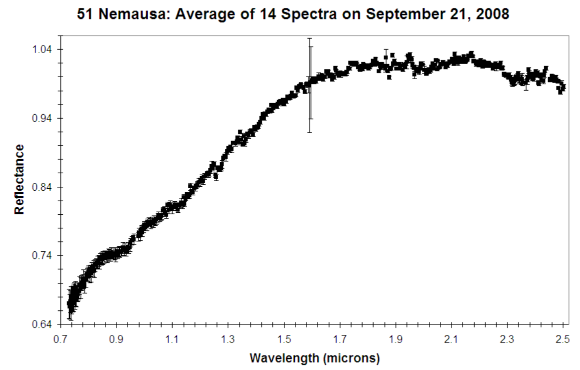

Figure 1. Near-infrared spectrum of 51 Nemausa: average of 14 spectra on September 21, 2008.

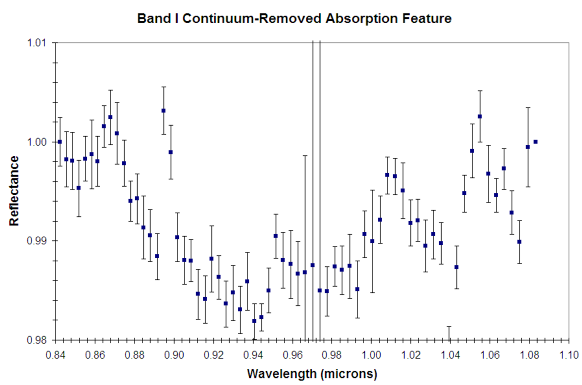

Figure 2. Continuum-removed Band I feature.

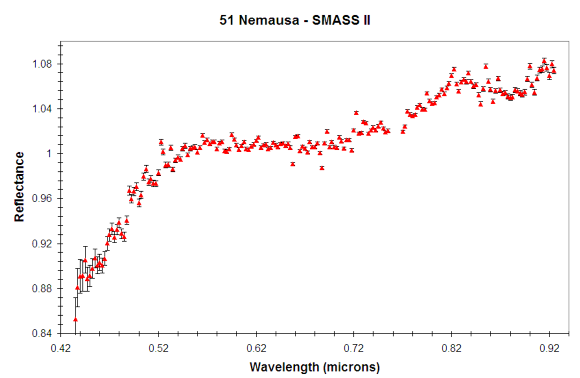

Figure 3. SMASS II [3] visible spectrum of 51 Nemausa.

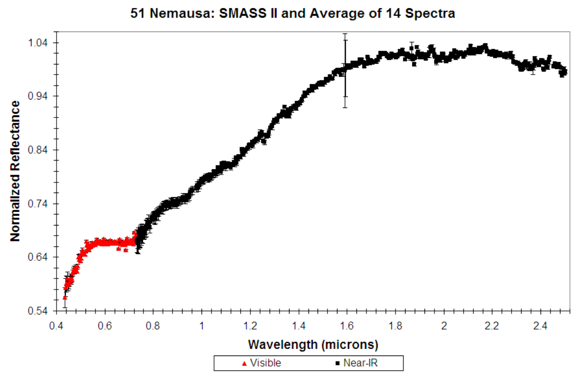

Figure 4. SMASS II [3] visible spectrum normalized to the near-infrared spectrum of 51 Nemausa.

Possible Meteorite Analog: Carbonaceous chondrites, particularly CI1 and CM2 chondrites, have been suggested as a possible meteorite analog for 51 Nemausa [9,12]. CI1 and CM2 chondrites have a mineralogy consisting of fine-grained Fe-rich phyllosilicates, with other minor materials such as carbonates, sulfates, and sulfides [15]. The absorption features produced by these meteorites are from the oxidized iron in the phyllosilicates [16]. Phyllosilicates in the meteorites produce characteristic absorption features at ~0.43-, ~0.60-0.65-, ~0.70-, ~0.80-0.90-, ~1.40-, ~1.90-, ~2.00-, ~2.20-2.40-, and ~3.0-µm [5, and references therein].

A visible spectral curve match was made, with a difference ≤ 3%, between 51 Nemausa and antarctic CM2 chondrite LEW90500 by [9] and suggested that the asteroid could be a parent body of CM chondrites. However, it is important to note that antarctic meteorites have been heavily weathered by terrestrial processes and the effects of this have not been well constrained.

Conclusions: The visible and near-IR spectra of 51 Nemausa show absorption features at ~0.70- and ~0.90-µm. Based on meteorite spectra of carbonaceous chondrites by [17], these absorption features could be due to the presence of phyllosilicates on 51 Nemausa's surface. The exact nature of the phyllosilicates cannot be determined since both Mg- and Fe-bearing phyllosilicates exhibit the same spectral features [5].

The likelihood of 51 Nemausa having phyllosilicates, as indicated by the absorption features, and opaque phases (e.g., carbon), as seen in 51 Nemausa's low geometric albedo, on its surface suggests that it is a possible parent body of carbonaceous chondrites, particularly CI1 or CM2 chondrites.

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