CONSTRAINING METEORITE ANALOGS FOR THE EOS DYNAMICAL FAMILY VIA MINERALOGICAL BAND ANALYSIS. P. S. Hardersen[1], T. Mothe'-Diniz[2], and E. A. Cloutis[3]. [1]University of North Dakota, Department of Space Studies, 4149 University Avenue, 530 Clifford Hall, Box 9008, Grand Forks, ND 58202, Hardersen@space.edu, [2]Universidade Federal do Rio de Janeiro/Observatorio do Valongo, Lad. Pedro Antonio, 43-20080-090 Rio de Janeiro, Brazil, thais.mothe@astro.ufrj.br. [3]Department of Geography, University of Winnipeg, Winnipeg, MB R3B 2E9.

Introduction: The Eos dynamical family was classified by [1] and is located in the main asteroid belt beyond the 5:2 mean-motion resonance. The archetype of the family, 221 Eos, has a = 3.01AU, i = 10.9°, and e = 0.105. This asteroid family includes 202 members according to [1]. Early work by [2] suggested that Eos family members were populated by S-type asteroids, but more recent work by [3] analyzing visible-λ spectra suggested compositional diversity, evidence for space weathering, and possible affinities to the CO and CV chondrites for the Eos family. [4] and [5] have examined collisional and dynamical evolution of the Eos family with [4] identifying likely Eos family members in the 9:4 mean-motion resonance.

[6] suggested both chondritic and achondritic analogs for 221 Eos while [7] conducted a near-infrared spectral survey of 30 Eos family members and suggested CK chondrites as a potential analog, along with the possibility of partial melting among family members. The analysis by [7] included spectral curve matching, application of the Hapke mixing model, and MGM analysis.

As a part of [8], three olivine-bearing Eos family members (766 Moguntia, 798 Ruth, 1210 Morosovia) were included in a NIR spectral survey of M-/X-type asteroids. Five Eos family members from [7], exhibiting Band I and Band II absorptions, were also analyzed in [8] to derive absorption feature band centers and band areas. Results of the band analyses suggested that CO chondrites are somewhat more consistent with the derived olivine-bearing asteroid band parameters in [8], but that CK-chondrites, CV-chondrites, R-chondrites, ureilites, and brachinites remain potential meteorite analogs. Table 1 below displays the band centers derived from Eos family members displaying Band I and Band II features.

Table 1:

Asteroid	Band I (µm)	Band II (µm)
633 Zelima	1.057 ± 0.003	1.940 ± 0.005
661 Cloelia	1.044 ± 0.004	1.929 ± 0.017
669 Kypria	1.047 ± 0.004	1.931 ± 0.008
1210 Morosovia	1.047 ± 0.009	1.883 ± 0.049
1413 Roucarie	1.067 ± 0.005	1.908 ± 0.008
1416 Renauxa	1.045 ± 0.007	1.897 ± 0.019

Two Eos family asteroids in [8] and two additional asteroids in [7] display Band I features only. Table 2 below shows the derived Band I centers for these asteroids.

Table 2:

Asteroid	Band I (µm)
766 Moguntia	1.068 ± 0.004
798 Ruth	1.056 ± 0.004
1903 Adzhimushkaj	1.049 ± 0.003
2957 Tatsuo	1.044 ± 0.003

Methodology: This work will conduct band center and band area analysis of the remaining Eos family member near-infrared (NIR) spectra from [7]. NIR spectral band centers are derived by applying a linear continuum across an absorption feature and then taking the ratio of the feature to the linear continuum that extends to the local maxima bounding the absorption feature [9]. This produces a continuum-removed absorption feature. Polynomial functions of various orders are fit across the absorption band to determine band centers. Band centers and band areas are calculated via MATLAB routines.

Band areas are determined by calculating the entire area of an individual continuum-removed absorption feature [9]. When possible, the Band Area Ratio (BAR) will be calculated for each Eos family member exhibiting both a Band I and Band II absorption feature.

Meteorite Analogs: RELAB and HoserLab visible-/NIR- (VNIR) spectra of CK-, CV-, CO-, and R-chondrites, as well as VNIR spectra of ureilites and brachnites, were analyzed to compare band parameters of the lab samples to those of the asteroids [10]. [8] describes the procedures used to acquire the laboratory VNIR spectra. Table 3 shows the band parameters for Brachina and three ureilites.

Table 3:

Meteorite	Band I (µm)	Band II (µm)
Brachina	1.057	
EET87720	0.920	1.949
LEW88201	0.938	--
META78008	1.028	--

Table 4 displays the band parameters for four CO3 chondrites and one R3-chondrite (PRE95404).

Table 4:

Meteorite	Band I (μm)	Band II (μm)
ALH82101	1.064	1.940
FRO95002	1.062	2.044
FRO99040	1.069	2.033
MET00737	1.059	1.969
PRE95404	1.064	2.163

Table 5 displays the band parameters for five CK-chondrites.

Table 5:

Meteorite	Band I (μm)	Band II (μm)
MET01149	1.065	2.075
PCA91470	1.068	2.077
DAV92300	1.067	1.980
ALH85002	1.064	2.012
EET83311	1.066	--

Results: As a whole, the Eos family members with NIR spectra show the ubiquitious presence of a weak olivine feature that ranges in band depth from ~4-10%. A minority of these asteroids shows a Band II feature, which is indicative of the presence of pyroxene. The Band II centers in Table 1 are consistent with the surface presence of orthopyroxene ± Type B clinopyroxene [8]. CO3 chondrites in Table 4 are most consistent with the Eos asteroids' Band II data in Table 1, but still have band centers at mostly longer wavelengths than the Eos asteroids.

Band I centers are not diagnostic for a single meteorite analog because of the small change in band center with changing olivine Fe^{2+} content and the resulting low-precision of the olivine calibrations [11] [12]. All of the meteorite analogs, except the ureilite samples, are consistent with the Eos asteroids' Band I centers.

Meteorite band areas are also not diagnostic of a specific meteorite type because of mineralogic heterogeneity within meteorite samples. However, [8] shows that Eos family asteroids' Band II depths are generally consistent with the meteorites' Band II depths, which suggests that opaque minerals on Eos family asteroids are a more likely explanation than space weathering for the weak band depths.

Future Work: Band centers and areas will be determined for the remaining NIR spectra of Eos family members from [7]. The entire band parameters data set, including band centers and areas, will be compared with existing and additional meteorite band parameters to attempt to better constrain the possible meteorite analogs for this asteroid family. The band parameter analysis will also be compared with the analyses in [7], and other existing analyses, to continue developing a comprehensive understanding of the mineralogical nature of the Eos asteroid family.

References:

[1] Zappala V. et al. (1990) *Astron. J.*, *100*, 2030-2046. [2] Gradie J. C. (1978) Ph.D. thesis. [3] Doressoundiram A. et al. (1998) *Icarus, 131,* 15-31. [4] Binzel R. P. (1988) *Icarus*, *73,* 303-313. [5] Zappala V. et al. (2000) *Icarus, 145,* 4-11. [6] Burbine T. H. et al. (2001) *Met. Planet. Sci., 36,* 245-253. [7] Mothe'-Diniz T. et al. (2008) *Icarus, 195,* 277-294. [8] Hardersen P. S. et al. (2011) *Met. Planet. Sci.,* in review. [9] Cloutis E. A. et al. (1986) *JGR, 91,* 11641-11653. [10] Cloutis E. A. et al. (2006) *LPS XXXVII,* Abstract #2121. [11] King T. V. V. and Ridley W. I. (1987) *JGR, 92,* 11457-11469. [12] Reddy V. et al. (2011) *Planet. Space Sci.,* in review.