ROSETTA FLYBY TARGET ASTEROID (2867) STEINS: AN ENSTATITE ACHONDRITE ANALOGUE. P. A. Abell[1,2], P. R. Weissman[3], M. D. Hicks[3], Y. J. Choi[3], and S. C. Lowry[3], [1]Planetary Science Institute, 1700 E. Fort Lowell, Suite 106, Tucson, AZ 85719, abell@psi.edu. [2]NASA Johnson Space Center, Houston, TX 77058. [3]Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109.

Introduction: On September 5, 2008, the European Space Agency's Rosetta spacecraft will flyby mainbelt asteroid (2867) Steins enroute to its primary target, comet 67P/Churyumov-Gerasimenko. Given that little information was known about Steins prior to its selection as a Rosetta flyby target in 2004, a ground-based observational campaign was undertaken to ensure that good constraints of the asteroid's physical characteristics were measured before the encounter.

Observations: CCD spectroscopic (~0.33 to 0.93 µm) reflectance observations of asteroid (2867) Steins were obtained to further investigate its compositional characteristics and determine the most likely meteoritic analogue. Given that the rotation period of this asteroid was previously determined to be ~6.05 hr [1], two sets of spectra were collected over a ~3 hr interval in order to obtain data on each hemisphere of the asteroid. An examination of the spectra demonstrates that the asteroid has a significant absorption feature located near 0.50 µm, and a red spectral slope at longer wavelengths up through 0.92 µm. In addition, previous investigators have determined that the albedo of Steins is ~0.30-0.55 [2,3]. This suggests that it has spectral properties most consistent with the E-type asteroids, which are known for their high albedos [4].

Interpretation: Some E-type asteroids are distinguished from other E subtypes by spectral absorption features located near 0.50 µm and 0.96 µm. E(II)-type asteroids (64) Angelina and (3103) Eger have been observed to have features located near 0.50 µm [5], and both of these asteroids have high albedo values [6,7,8]. The preferred mineralogical interpretation is that these features are produced as a result of the presence of the calcium sulfide mineral, oldhamite (CaS) on the surface of these asteroids [9,10]. Oldhamite is characterized by two absorption features located near 0.50 µm and 0.96 µm that are probably produced by trace amounts of a bivalent ion, such as Fe^{2+}, that has been substituted into the sulfide instead of Ca^{2+}. In addition, oldhamite is present only in highly reduced mineral assemblages such as aubrite (enstatite achondrite) meteorites [11,12].

Conclusions: A comparison of laboratory spectra of aubrite ALH 78113 to the Steins data suggests that there is a plausible similarity between this meteorite and the asteroid in terms of albedo and absorption features. Hence the most likely meteoritic analogue to Steins is an aubrite with a spectrally significant amount of sulfide (e.g., CaS) present in its assemblage.

References: [1] Weissman et al. (2007) *Astron. & Astrophys.*, 466, 737-742. [2] Fornasier et al. (2006) *Astron. & Astrophys.*, 449, L9-L12. [3] Lamy, et al. (2006) *BAAS* 38, #59.09. [4] Barucci et al. (2005), *Astron. & Astrophys.*, 430, 313-317. [5] Fornasier and Lazzarin (2001) *Icarus*, 152, 127-133. [6] Tedesco et al. (1989) *Asteroids II*, Univ. of AZ Press, pp. 1151-1161. [7] Veeder et al. (1989) *Astron. Journ.*, 97, 1211-1219. [8] Benner et al. (1997) *Icarus*, 130, 296-312. [9] Burbine et al. (2002) *MAPS*, 37, 1233-1244. [10] Gaffey and Kelley (2004) Abs. #1812, *Lunar & Planet. Sci. Conf.* 35. [11] Keil (1989) *Meteoritics*, 24, 195-208. [12] Fogel (1997) *MAPS*, 32, 577-591.