SPECTROSCOPIC SURVEY OF E-TYPE ASTEROIDS, INCLUDING 2867 STEINS, A TARGET OF THE ROSETTA MISSION.

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Introduction: We present the results of a spectroscopic survey on igneous E-type asteroids started on 2004 at the 3.5m Telescopio Nazionale Galileo (TNG) and at the 3.5m New Technology Telescope (NTT) of the European Southern Observatory.

We obtained new visible spectra for eighteen out of the 25 known E-type asteroids, including 2867 Steins, a target of the Rosetta mission, and near infrared spectra for eight of them.

We confirm the presence of three different mineralogies in the small E-type populations. We classify each object in the E[I], E[II] or E[III] subgroups following Gaffey & Kelley classification scheme [1], on the basis of the spectral behavior and of the eventual presence of absorption features attributed to sulfides (such the 0.49 μm band, on E[II]), or to iron bearing silicates (0.9 μm band, on E[III]).

2867 Steins shows a spectral behavior typical of the E[II] subgroup, as already suggested by [2], [3], and its spectrum is strongly similar to that of the NEO 3103 Eger, also belonging to the same subgroup.

On the basis of this strong spectral similarity, Fornasier et al. [3] suggest that these two objects might have a possible common origin in spite of their presently different orbits, and that they might be both remnants of an old asteroid family, the outcome of the breakup of a parent body at about 2.36 AU (the semimajor axis of Steins). Numerical orbital integrations show that there is a dynamical pathway between the present orbit of Steins, possibly the largest remnant of the family, and Earth–crossing orbits like that of Eger.

Few objects (i.e. 64 Angelina, 317 Roxane, and 434 Hungaria) present different spectral behaviors in our data and those coming from literature, and we suggest that they may have an inhomogeneous surface composition. Our V+NIR spectral observations of 2577 Litva, 1990 TN1, 5806 Archieroy, ruled out the E-type classification in favour of the olivine rich A-class for the first 2 objects, and of the S(V) (following the Gaffey et al. classification scheme [4]) for 5806 Archieroy.

To fully investigate the E-type population, we enlarged our sample including 6 E-asteroids spectra available in literature, resulting in a total sample of 21 objects. The analysis of the spectral slope for the 3 different E-subgroups versus the orbital elements show that E[III] members have the lowest mean spectral slope value inside the whole sample, and that they are located between 2.2-2.7 AU in low inclination orbits. E[II] members has the highest spectral slope inside the sample, half of them are located in the Hungaria region, 2 are NEA and 2 (64 Angelina and 2867 Steins), are in the main belt. A similar distribution is found for the 5 featureless E[I] members, located mainly in the Hungaria region (3 members), one in the middle main belt while one is a NEA (2004 VD17).

Finally, for the five E-type asteroids observed both in the visible and near infrared range, plus 2867 Steins, we attempt to model their surface composition using linear geographycal mixtures of no more than 3 components, selected from aubrite meteorites and correlated minerals. In particular we suggest that the aubrite Pena Blanca might have the E[III] asteroid 317 Roxane as parent body, and that the aubrite ALH78113 might be related to the E[II] subgroup asteroids.

References:

[1] Gaffey, M. J. & Kelley, M.S., (2004), LPS XXXV, abstract #1812. [2] Barucci et al. (2005) Astron. Astroph. 430, 313--317. [3] Fornasier et al. (2007) Astron. Astroph. 474, 29--32. [4] Gaffey et al. (1993) Icarus 106, 573-602.