ANALYSIS OF THE ENTRY IN THE ATMOSPHERE OF A METEOROID FROM COMET 2P/ENCKE. J. Izquierdo[1], J.M. Madiedo[2], J.L. Ortiz[2], D. Rodríguez-Struve[3], J. Aceituno[4], E. de Guindos[4]. [1]Departamento de Física de la Tierra y Astrofísica, Universidad Complutense de Madrid, 28040 Madrid, Spain. [2]Departamento de Sistema Solar, Instituto de Astrofísica de Andalucía (IAA-CSIC), 18080 Granada, Spain. [3]Parc Astronòmic del Montsec, Lleida, Spain. [4]Observatorio Astronómico de Calar Alto (CAHA), E-04004, Almería, Spain.

Introduction: It has been shown that the Taurids contain very large (even meter-sized) meteoroids [1]. In fact, since the Taurid meteoroid complex is thought to have originated through the cascade disintegration of a large comet, the existence of these large fragments is not surprising. This stream is also known for producing very bright fireballs [2]. In addition, it has been found that some of these meteoroids exhibit very large tensile strength values [3]. This, together with a not too high entry velocity for particles from this stream (around 28 km s^{-1}), led some authors to propose that the Taurids could be regarded as potential meteorite-producers [2]. In fact, along the last decade several deep-penetrating Taurid bolides with non-zero terminal mass have been reported in the scientific literature, although said mass was always small (a few grams), and the resulting meteorites could not be recovered [2, 4]. In this context, we present here the preliminary analysis of a large Taurid fireball that overflew the south of France on 2022 November 18. This extraordinary event was recorded and analyzed in the framework of the Southwestern Europe Meteor Network (SWEMN) and the survey that this network conducts to analyze the interaction of meteoroids with the Earth's atmosphere: the SMART project (Spectroscopy of Meteoroids in the Atmosphere by means of Robotic Technologies), which was started in 2006 [5].

Instrumentation and methods: The event discussed here has been recorded by using Watec 902H2 and Watec 902 Ultimate cameras. Their field of view ranges from 62x50 degrees to 14x11 degrees. We have also employed different models of Sony digital CMOS color cameras operating in HD video mode (1920x1080 pixels). These cover a field of view of around 70x40 degrees. A detailed description of this hardware and the way it operates was given in previous works [6]. The atmospheric path of the event was triangulated by using the SAMIA software, developed by J.M. Madiedo. This program employs the planes-intersection method.

Preliminary analysis: This stunning event was spotted on 2022 November 18, at 0h03m02.0±0.1s UT (Figure 1). The maximum luminosity the bright meteor, that exhibited a bright flare at the central part of its trajectory in our atmosphere, was equivalent to an absolute magnitude of -12.0±1.0. This flare took place as a consequence of the sudden break-up of the meteoroid when the aerodynamic pressure exceeded the tensile strength of the particle. The persistent train left by the fireball and its evolution with time was also obtained from Àger. The event was listed in the SWEMN meteor database with the code SWEMN20221118_000302.

Figure 1. Sum-pixel image of the fireball discussed in this work, as recorded from Àger.

By triangulating the atmospheric trajectory of the event it was inferred that this bright meteor overflew the south of France. The initial phase of the luminous path of the event took place at an altitude H_b=98.1±0.5 km, and the terminal point was located at a height H_e=64.8±0.5 km. The equatorial coordinates of the apparent radiant yield α=58.99º, δ=16.14º. The entry velocity in the atmosphere calculated for the progenitor meteoroid was V_∞=27.5±0.3 km/s. Figure 2 shows the trajectory in the atmosphere and its projection on the ground.

The event was named "Les Peyrots", since the bolide overflew this locality during its final phase. Table 1 shows the orbital parameters of the progenitor meteoroid before its encounter with our planet, and the geocentric velocity yields V_g=25.1±0.3 km/s. The Tisser-

and parameter with respect to Jupiter (T_J=2.78) reveals that the particle was moving on a cometary (JFC) orbit before hitting the Earth's atmosphere (Figure 3). By taking into account this orbit and the radiant position, we found that the meteor was generated by the Southern Taurids (IAU meteor shower code STA#0002). The accepted parent body of this shower, which peaks around November 6, is Comet 2P/Encke [3].

Figure 2. Atmospheric path of the SWEMN20221118_000302 "Les Peyrots" bolide, and its projection on the ground.

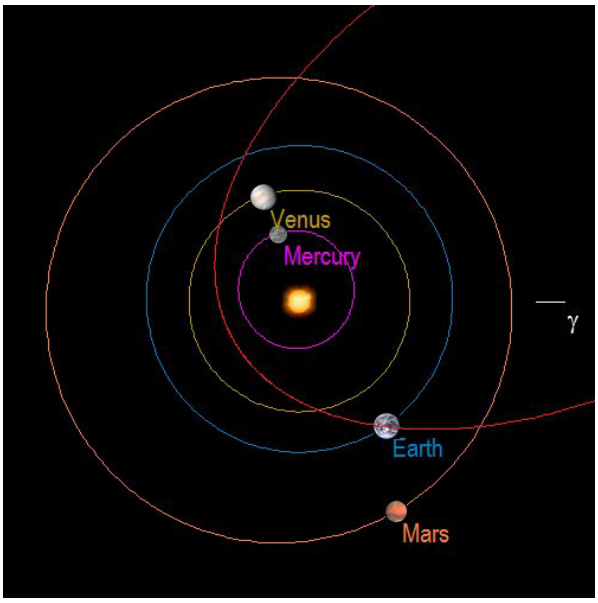

Figure 3. Projection on the ecliptic plane of the orbit of the SWEMN20221118_000302 "Les Peyrots" fireball.

Conclusions: We have presented a preliminary analysis of a mag. -12±1 fireball observed over France on 2022 November 18. The bolide was recorded and studied in the framework of the SWEMN network and the SMART project. The calculated radiant and orbital parameters show that the progenitor meteoroid belonged to the Southern Taurid stream. The bolide penetrated the atmosphere till a final height of 64.8±0.5 km. The persistent train left by the fireball in the atmosphere was also recorded, and its evolution with time is currently being analyzed.

a (AU)	2.6±0.1	**ω (º)**	96.17±00.02
e	0.813±0.009	**Ω (º)**	55.276683 ± 10^{-5}
q (AU)	0.497±0.003	**i (º)**	4.55±0.03

Table 1. Orbital data (J2000) of the progenitor meteoroid.

Acknowledgements: We acknowledge support from the Spanish Ministry of Science and Innovation (MICIN) and the State Agency for Research (AEI) through project PID2019-105797GB-I00. We also acknowledge financial support from the State Agency for Research of the Spanish MCIU through the "Center of Excellence Severo Ochoa" award to the Instituto de Astrofísica de Andalucía (SEV-2017-0709)". The authors thank *Fundación AstroHita* for its support in the establishment and operation of the automated meteor observing station located at La Hita Astronomical Observatory (La Puebla de Almoradiel, Toledo, Spain).

References: [1] Wetherill G.W. (1974). Annual Review of Earth and Planetary Sciences, 2, 303. [2] Madiedo J.M. et al. (2014). Icarus, 231, 356. [3] Konovalova N.A. (2003). A&A, 404, 1145 [4] Brown P. et al. (2013). Meteoritics and Planetary Science, 48, 270. [5] Madiedo J.M. (2014), Earth, Planets & Space, 66, 70. [6] Segura J. and Madiedo J. M. (2019), 50th Lunar and Planetary Science Conference 2019 (LPI Contrib. No. 2132).