ANALYSIS OF A DAYTIME FIREBALL WITNESSED ON AUGUST 10, 2012 OVER THE IBERIAN PENINSULA. J. A. Docobo[1] , J. M. Madiedo[2, 3], P. P. Campo[1] and J. M. Trigo-Rodriguez[4], [1]Observatorio Astronómico Ramón María Aller (OARMA). Universidade de Santiago de Compostela, Avda. das Ciencias, Campus Vida (antes Campus Sur). Santiago de Compostela, Spain, joseangel.docobo@usc.es. [2]Facultad de Ciencias Experimentales. University of Huelva. Avda de las Fuerzas Armadas S/N, 21071 Huelva, Spain, madiedo@uhu.es. [3]Departamento de Fisica Atomica, Molecular y Nuclear. Universidad de Sevilla. 41012 Sevilla, Spain. [4]Institute of Space Sciences (CSIC-IEEC). Campus UAB, Facultat de Ciències, Torre C5-p2. 08193 Bellaterra, Spain, trigo@ieec.uab.es.

Introduction: Meteorite-dropping bolides are rare events that may provide unique samples coming from other bodies in the Solar System. For this reason, the analysis of such events is one of the aims of the SPanish Meteor Network (SPMN), which is currently operating 25 meteor and fireball observing stations to monitor the night sky. In the evening of August 10, 2012, about half an our before sunset, a very bright fireball (at least mag. -14) was witnessed over the northwest of the Iberian Peninsula. The event took place under daylight conditions and, so, before our detection systems started operation. However, its observation was very favourable for numerous visual witnesses that could account for it. So, despite no images were recorded, the atmospheric path of the bolide could be reconstructed from the observation provided by these. In this work we present a preliminary analysis of this event. Our calculations reveal that, in fact, this fireball could have produced a meteorite, although this would have landed on the Cantabrian Sea.

Observational data: On August 10, 2012, at 19 h 17 min 30±30 s UTC, a bright fireball was observed over the north of Spain. This observation took place under daylight conditions and before SPMN cameras installed in nearby meteor stations started operation. Fortunately, numerous visual witnesses could account for it, and these were interviewed by a team belonging to OARMA (*Observatorio Astronómico Ramón María Aller*). Accordant to their reports, no sounds associated to the bolide were witnessed. We estimate that its absolute magnitude was -14, or even brighter. The fireball experienced a bright fulguration during the first half of its atmospheric trajectory, exhibiting a fragmentation near the end of this path. As a result of this disruption, two fragments moving in slightly different directions were seen.

In this research we have employed the same approach we followed for previous events [1, 2, 3]. Thus, visual witnesses were interviewed and precise visual measurements were performed with a theodolite at the same locations where the fireball was observed. In this way, the positions of the initial and final points of the apparent luminous trajectory were determined. These reports are summarized in Table 1 (azimuths were measured from the North). In some cases, however, these initial of final coordinates corresponded to the position of an object (house, tree, hill, etc.) that occulted the fireball.

Figure 1. Projection on the ground of the luminous trajectory of the SPMN090812 fireball witnessed on August 9, 2012, at 19 h 17 min 30±3 s UTC.

Preliminary results: For data reduction we have employed the AMALTHEA software [4, 5, 6]. This tool employs the planes intersection method [7] to determine the luminous trajectory and radiant. According to these calculations, the beginning point was located at φ=43.017º, λ=-5.627º, H=99.8 km, with the terminal point at φ=43.882º, λ=--7.569º, H=30.2 km. The coordinates of the apparent radiant are R.A=282.7º, Dec=3.4º. The first fulguration took place at about 79 km on the vertical of the coordinates (φ=43.257 º, λ=-6.1024º). The projection on the ground of this luminous trajectory is shown in Figure 1. Because of the low height of the terminal point, a meteorite fall seems to be likely. However, the meteorite would have landed on the Cantabrian Sea.

On the other hand, although there is not precise information about the velocity of the fireball, we can make some considerations about the likely orbit of the meteoroid. Thus, simulations reveal that a preatmospheric velocity higher than 21 km/s would result in a hyperbolic orbit. If we restrict ourselves to orbits with

e<1, this velocity would represent an upper limit. In fact, witnesses' reports are consistent with an entry velocity of about 17 km/s, According to this, the semi-major axis would be of about 2.5 UA, with an inclination of ~6 degrees. This would imply a likely asteroidal origin for the meteoroid.

Obs	Coordinates		Initial point		Final point	
#	φ (º)	λ(º)	A(º)	h(º)	A(º)	h(º)
1	+43º39'57"92	-7º35'45"85	53.6	26.3	7.1	29.9
2	+43º38'51"04	-8º02'37"69	140.0	29.3	50.7	22.1
3	+43º31'59"32	-7º02'01"34	60.0	80.0	-	30.0
4	+43º24'54"85	--8º09'57"05	-	-	43.5	9.0
5	+43º20'31"50	-8º24'18"59	53.0	22.7	34.0	19.2
6	+43º19'04"46	-8º51'08"49	42.1	21.3	39.5	7.2
7	+43º03'11"07	-8º24'24"82	80.0	24.5	59.0	15.0
8	+43º00'43"62	-7º33'40"94	66.1	45.0	47.9	27.3
9	+42º57'09"59	-8º30'13"20	46.1	20.0	30.1	8.0
10	+42º53'15"49	-8º38'08"58	77.6	25.6	50.5	11.0
11	+42º52'57"24	-8º31'05"65	48.2	21.5	22.5	10.0
12	+42º52'39"83	-8º32'39"29	48.0	15.0	33.1	9.1
13	+42º52'05"02	-8º32'39"55	63.3	30.0	35.1	9.0
14	+42º51'24"24	-8º34'43"00	43.1	31.1	37.1	9.9
15	+42º50'10"21	-8º26'55"46	43.0	20.0	39.0	18.0
16	+42º41'23"50	-8º41'00"94	78.9	27.0	68.8	18.6
17	+42º39'00"00	-8º49'20"04	75.0	27.0	41.1	8.0
18	+42º28'31"38	-7º55'10"00	19.0	8.0	6.0	8.0
19	+42º11'14"45	-7º47'28"03	-	-	3.0	7.0
20	+41º44'38"14	-6º29'09"97	7.0	30.0	-15.0	6.0

Table 1. Geographical coordinates of the visual witneses, with the corresponding observed azimuth (A) and altitude (h) of the initial and final points of the fireball analyzed in this work. Azimuths are measured from the North.

Conclusions: We have analyzed a very bright diurnal bolide witnessed over the northwest of Spain on August 10, 2012. The luminous phase of this event was characterized on the basis of the information provided by witnesses. The calculations reveal that this could have been a meteorite-producing fireball. However, fragments surviving the ablation process would have landed on the Cantabrian Sea.

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