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APPENDIX: METHODS

The complete dating protocol, detailed below, was inspired by the works of Vogt and Herpers (1988) and Merchel and Herpers (1999).

Metal extraction

Samples were grinded manually in an agate mortar, and the resulting powder (Ø <200µm) was completed with ethanol and for a two minutes bath in an ultrasonic cuve to break the silicate grains. Once dried, a magnetic separation was performed with a hand magnet. The magnetic extract was then washed in hydrochloric (0.2 $mol.L^{-1}$) and hydrofluoric (3.8 $mol.L^{-1}$) acids, during 30 and 10 min, respectively. The remaining grains were washed, dried, and a final visual inspection with a binocular microscope ensured the purity of the metallic extract.

Chlorine chemistry

The metal was then dissolved by nitric acid (2 $mol.L^{-1}$) and spiked with an enriched ^{35}Cl solution (6.92 $mg.g^{-1}$). Silver chloride precipitate was formed by adding 2 drops of silver nitrate (0.57 $mol.L^{-1}$) . We stored the tubes in the darkness to prevent photosensibility effects. The solid phase was centrifuged and washed with milliQ water. To remove all trace of sulfure, we added a saturated solution of $Ba(NO_3)2$ (0.5 mL) with milliQ water (1mL) and NH_3 (2 mL) to form a mixed precipitate of $BaSO_4$ and $BaCO_3$. The supernatant was filtered and completed with HNO_3 to form a new AgCl precipitate. We rinsed it with concentrated HNO_3 (4 mL) and twice with MilliQ water (5 mL) before the final drying.

Terrestrial age measurements

AgCl precipitates were transferred to Nickel cathodes and isotopic ratio $^{36}Cl/^{35}Cl$ measurements were performed at ASTER AMS facility. We derived the ^{36}Cl activity A_{mes} for each samples, what is directly related to the terrestrial age:

$$T_{age} = 1/\lambda \ln(A_{sat} / A_{mes})$$

where λ is the ^{36}Cl half-life (λ = (301±0.01) kyr; Bartholomew et al., 1955) and A_{sat} the saturation activity in chondritic meteorites exposed to cosmic rays. This value depends on the elemental composition of the dissolved metal. We therefore measured the bulk composition of all metallic fractions (Fe, Ni) by using the Thermoscientific ICap ICP-OES facility at Laboratoire G-Time at ULB. Some samples samples were analyzed by ICP-MS and ICP-OES at the Service d'Analyse des Roches et Minéraux (SARM, Nancy, France). The purity of the dissolved metal fraction was controlled by measuring the mass of dissolved Si for 23 samples: it is only 1‰ of the Fe+Ni mass on average, and 3‰ maximum. These compositions were then used as inputs in the model of Leya (2009) to compute the saturated activities assuming exposure in space for longer than 3 m.y., and meteoroid radii < 20 cm (these two conditions ensure that the ^{36}Cl content of the meteorite had reached saturation and that there was no significant shielding). The first assumption is validated by the compilation of chondrite exposure ages (e.g., Graf and Marti 1995), typically more than 4 Ma (> 10 λ). The second assumption is validated by the size distribution of meteoroids hitting the Earth: using a consensual mass distribution for meteorites hitting the Earth's surface (Huss, 1990), and assuming a mass loss of 99% during atmospheric entry, meteoroids with radius > 20 cm (~110 kg) represent less than 2% of meteoroids with terminal masses >10 g (the cut-off limit in the El Médano meteorite collection).

We computed a mean saturation activity of 22.9±0.2, 22.6±0.2 and 21.1±0.2 dpm.kg^{-1} for H, L and LL chondrites respectively, values that are consistent to those measured in the literature on meteorite falls (e.g., Nishiizumi et al., 1989; Graf et al., 2001; Dalcher et al., 2013). The hypothesized absence of high shielding is consistent with the small sizes of the studied meteorites (diameter < 10 cm). We derived the uncertainties on terrestrial ages by propagation, which leads to typical range from 60 to 90 ka (see the Data Repository). Finally, we checked that ^{36}Cl terrestrial production was insignificant to introduce a bias in the results by computing the in situ production at a typical El Médano location (24°40' S, 70°20' W, 2150 m altitude) following the model presented in Schimmelpfennig et al. (2009). This terrestrial ^{36}Cl production would lead to a saturation activity <10^{-3} dpm.kg^{-1} that is negligible with respect to the ^{36}Cl activities measured in this work (average 8.30 dpm.kg^{-1}, median 6.93 dpm.kg^{-1}, minimum 0.060 dpm.kg^{-1}).

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Table DR1

Name	Location		TKW (g)	Classification		Metal mass	Chemistry	Activity (dpm/kg)		Terrestrial age (kyr)	
	Latitude S	Longitude W		Group	W	(mg)	Fe/Ni	Measured	Saturated	Value	Uncertainty
El Médano 004	24.63970	70.28536	151	H4	1	536.9	14.2	10.0	23.8	360	80
El Médano 017	24.65013	70.34148	156	L6	3	297.2	14.4	12.0	23.8	280	80
El Médano 020	24.74247	70.36155	102	L6	3	16.9	6.1	0.18	23.1	2110	70
El Médano 023	24.74006	70.36415	115	L6	3	161.4	6.9	15.5	23.3	170	80
El Médano 025	24.74408	70.36836	132	H6	3	172.5	13.1	2.37	23.7	980	80
El Médano 026	24.74389	70.36794	154	L6	3	193.6	8.9	11.4	23.5	300	80
El Médano 027	24.73737	70.36348	46	H5	3	28.2	4.4	2.42	22.7	970	65
El Médano 029	24.73628	70.36338	141	L5	1	107.8	5.7	16.1	23.1	160	60
El Médano 037	24.73607	70.36379	111	L6	3	154.1	10.0	16.0	23.6	150	80
El Médano 042	24.68999	70.32799	23	L6	3	58.8	4.3	1.12	22.7	1310	65
El Médano 049	24.68043	70.30820	138	H4	3	379.2	12.7	0.286	23.7	1900	80
El Médano 055	24.66624	70.31380	34	H6	2	228.2	5.6	6.25	23.1	570	60
El Médano 070	24.67364	70.30758	51	L6	3	57.4	8.3	12.4	23.4	270	60
El Médano 071	24.67429	70.30956	163	H5	2	107.8	7.7	12.3	23.4	280	60
El Médano 075	24.72142	70.33887	186	L4	3	198.7	8.2	0.980	23.4	1370	80
El Médano 078	24.67880	70.29813	1228	L6	3	186.3	7.0	13.1	23.3	240	80
El Médano 079	24.72253	70.33885	230	H5	2	131.2	13.3	6.96	23.7	520	80
El Médano 086	24.67906	70.30680	1258	H4	1	387.7	10.4	8.30	23.6	440	80
El Médano 089	24.67950	70.30941	296	L6	4	57.6	8.4	4.28	23.4	730	80
El Médano 092	24.71981	70.33905	289	H6	3	485.7	13.1	2.29	23.7	1000	80
El Médano 095	24.66838	70.32034	72	LL6	3	24.9	1.5	9.75	20.9	330	70
El Médano 097	24.71946	70.33881	229	L5-6	4	77.1	6.1	0.756	23.1	1500	75
El Médano 098	24.72140	70.33869	135	L6	4	31.9	8.5	2.01	23.4	1000	80
El Médano 099	24.72185	70.33874	11	H5	3	63.5	8.1	0.239	23.4	1990	75
El Médano 103	24.66360	70.32078	61	LL6	2	46.4	2.1	17.8	21.5	80	70
El Médano 104	24.67334	70.31084	27	LL5	3	31.7	2.3	17.2	21.7	100	65
El Médano 111	24.69066	70.32783	139	H5	4	22.6	11.8	0.711	23.7	1500	80
El Médano 113	24.67890	70.30782	37	L6	3	34.6	4.0	4.17	22.6	730	70
El Médano 115	24.66145	70.32517	84	H5	1	72.2	3.0	3.92	22.2	750	70
El Médano 118	24.72338	70.33923	161	H5	3	258.9	15.7	7.94	23.8	460	75
El Médano 126	24.72650	70.33294	584	H5	3	164.0	12.0	5.10	23.7	650	75
El Médano 128	24.66890	70.32116	556	L6	2	138.5	7.0	17.0	23.3	130	80
El Médano 129	24.66337	70.32145	28	L6	2	60.7	3.7	20.3	22.5	50	65
El Médano 135	24.68429	70.33038	71	L6	3	87.7	8.0	1.00	23.4	1400	75
El Médano 170	24.80572	70.37889	3893	L4	2	39.2	3.8	13.9	22.5	210	65
El Médano 172	24.71886	70.34167	1097	H5	2	37.5	5.7	14.8	23.1	190	65
El Médano 173	24.71625	70.34267	448	L6	2	93.9	4.3	17.3	22.7	120	60
El Médano 191	24.71964	70.33857	138	H5	2	155.7	6.4	1.88	23.2	1100	80
El Médano 199	24.71987	70.33869	148	H6	1	316.7	5.5	4.66	23.0	690	60
El Médano 231	24.77433	70.36595	15	H4	2	115.4	7.6	18.2	23.3	110	60
El Médano 236	24.71573	70.34702	106	H5	1	25.3	3.4	3.99	22.4	750	70
El Médano 245	24.66422	70.29570	37	H5/6	2	227.2	8.0	0.585	23.4	1600	70
El Médano 253	24.66736	70.29281	127	L6	2	50.9	3.3	21.9	22.3	10	60
El Médano 257	24.66656	70.29664	20	L3	2	90.3	4.2	0.971	22.7	1370	70
El Médano 261	24.67494	70.28988	52	H3	2	112.6	10.1	7.44	23.6	500	60
El Médano 263	24.78322	70.36719	14	L6	3	61.6	3.9	20.1	22.6	50	65
El Médano 276	24.79422	70.36600	1711	L6	3	82.7	6.8	16.0	23.2	160	60
El Médano 278	24.76319	70.36533	155	H5	2	257.1	6.8	13.7	23.2	230	60
El Médano 286	24.64128	70.31832	7	L6	3	65.6	6.5	1.44	23.2	1210	70
El Médano 304	24.74430	70.35639	213	H5	1	118.9	10.4	4.31	23.6	740	60
El Médano 309	24.66302	70.29758	133	H5	3	197.5	10.2	16.6	23.6	150	60
Caleta el Cobre 06	24.42345	70.29758	179	L6	3	64.8	12.5	0.0603	23.7	2590	100
Caleta el Cobre 15	24.42881	70.30535	115	L6	3	105.8	10.0	6.89	23.6	520	75
Caleta el Cobre 20	24.42504	70.30574	633	H5	3	366.8	13.1	1.61	23.7	1150	80