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Orbitally forced environmental changes during the accumulation of a Pliensbachian (Lower Jurassic) black shale in northern Iberia

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Figure S1. A) Geological map of the Santiurde de Reinosa area, where the herein studied motorway section (B) and the train station section studied by others (C) are located. Calcareous couplets in both Santiurde outcrops are numered in white and bundles B8-B11 in green. Bed by-bed correlation between separate and discontinuous outcrops was carried out on visual grounds, by the identification of key beds with distinctive sedimentary features (mainly lithology and thickness) and characteristic bed arrangements in the succession.

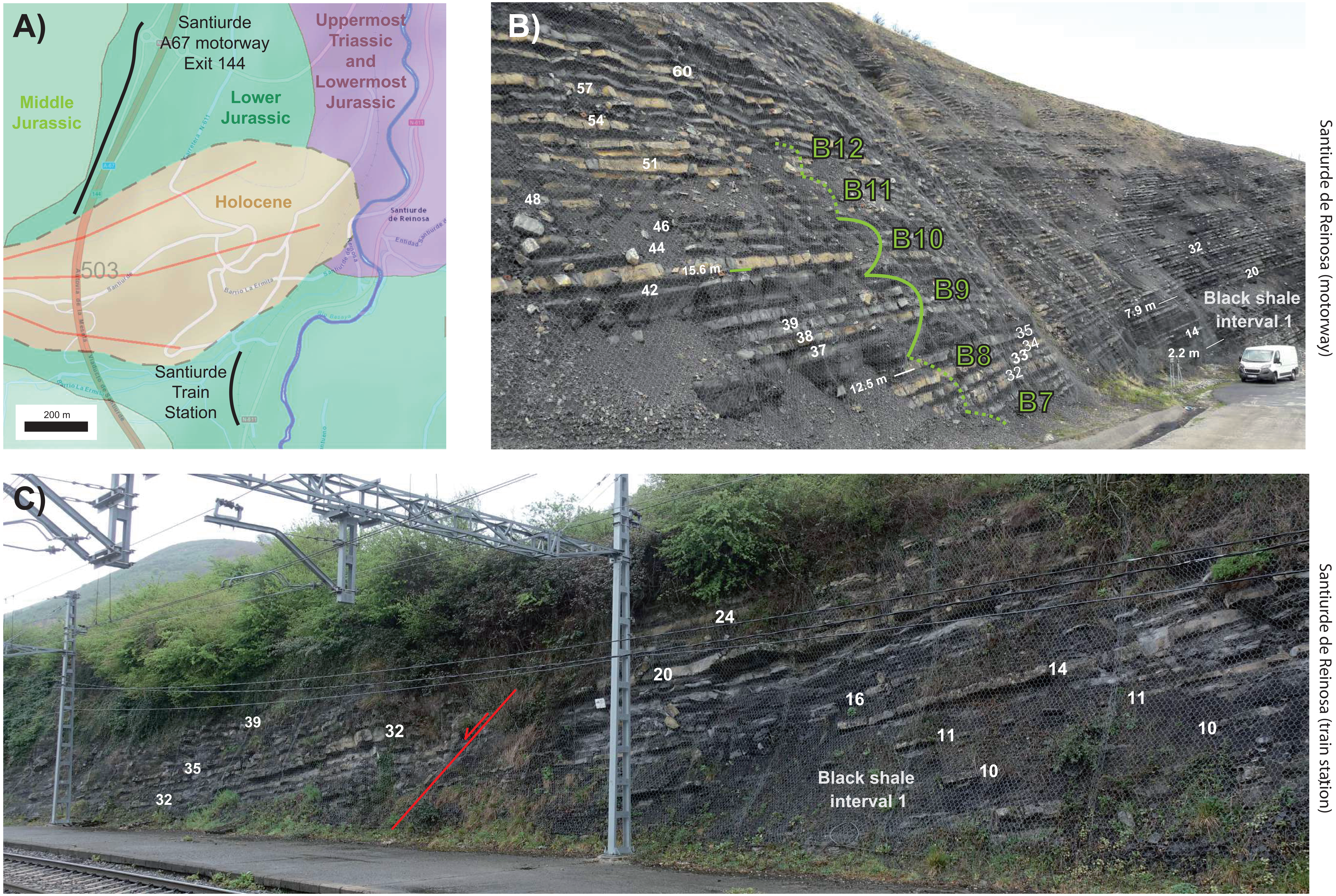


Figure S2. Stratigraphic log and chronostratigraphy of the studied section, showing the MS and colour data curves. Bundles (B) and couplets (C) identified in the sedimentary alternation are numbered in ascending stratigraphic order. The grey background shows the extent of the Uptonia jamesoni Black Shale 1, and the pink interval in its upper part shows the interval studied herein in detail. Close-ups of the colour and $\%CaCO_3$ curves of the interval studied in detail are shown, as well as the crossplot of both variables and their Pearson correlation value (r). Crossplots of colour vs MS of the complete section and $\%CaCO_3$ vs MS of the interval studied in detail are also shown.

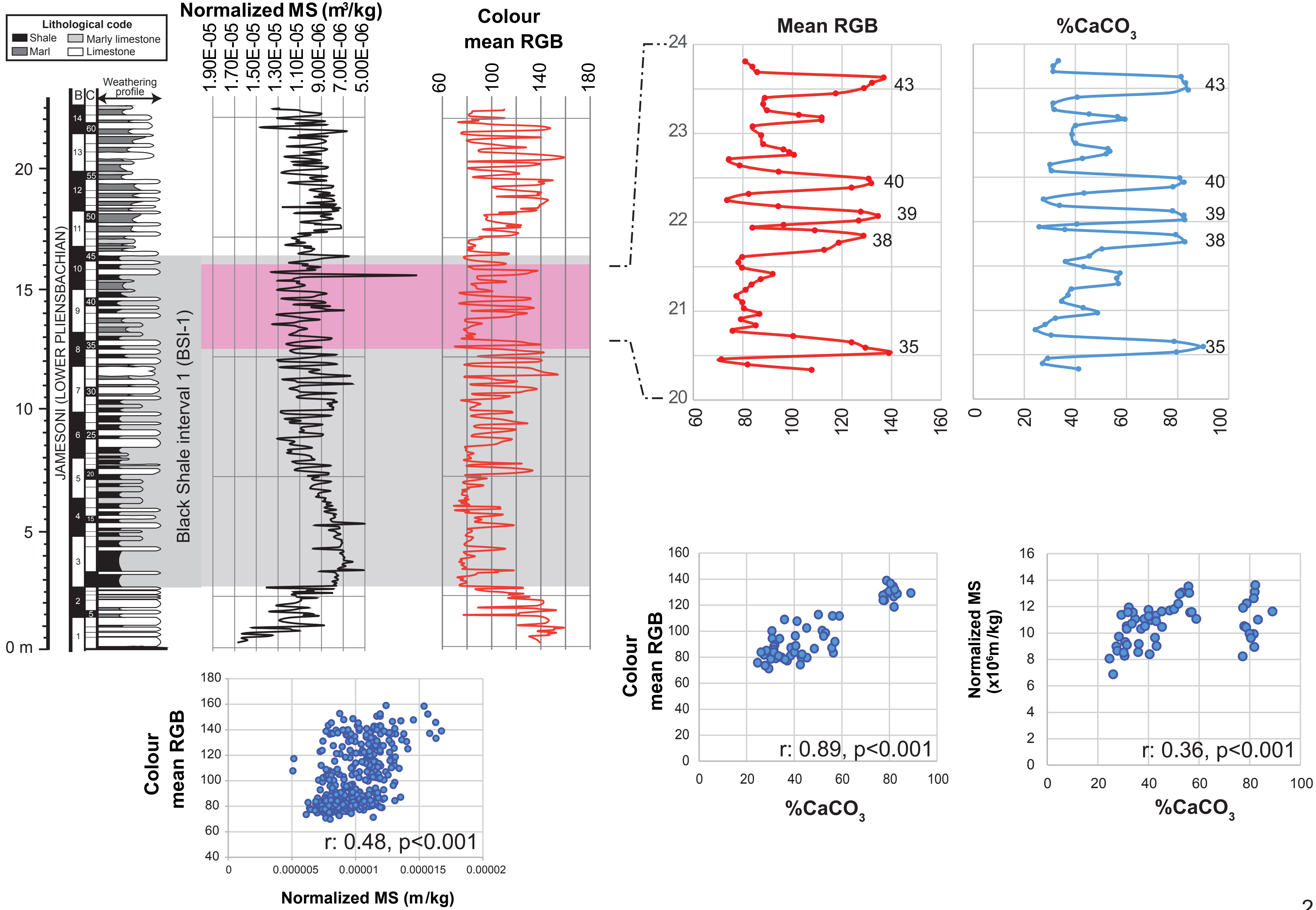


Figure S3. A) Thermomagnetic curve of a limestone sample (C43L) indicating the presence of an original ferromagnetic phase (magnetite). Secondary magnetic iron sulfides (pyrrhotite?) are created upon heating the sample up to 700ºC as inferred from the cooling curve. B) Isothermal remanent magnetization (IRM) acquisition curves for a limestone (C43L) ans marl (C43M) samples compatible with magnetite as the ferromagnetic carrier. Note the higher saturation remanence for the limestone sample.

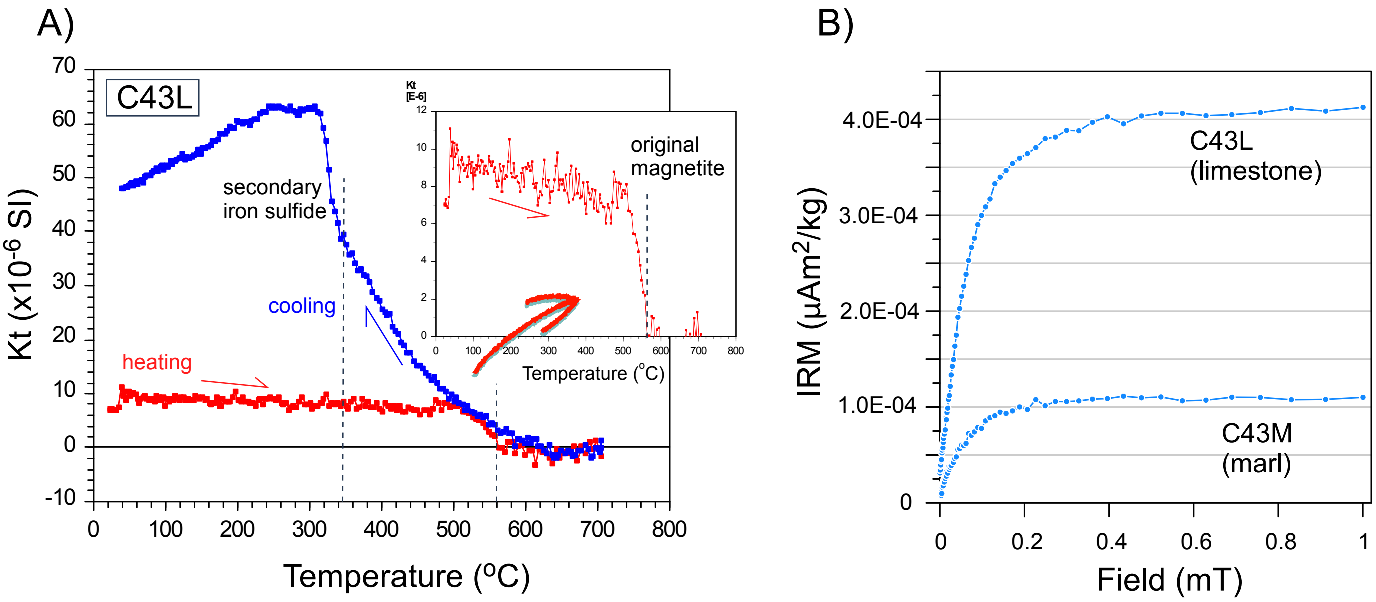
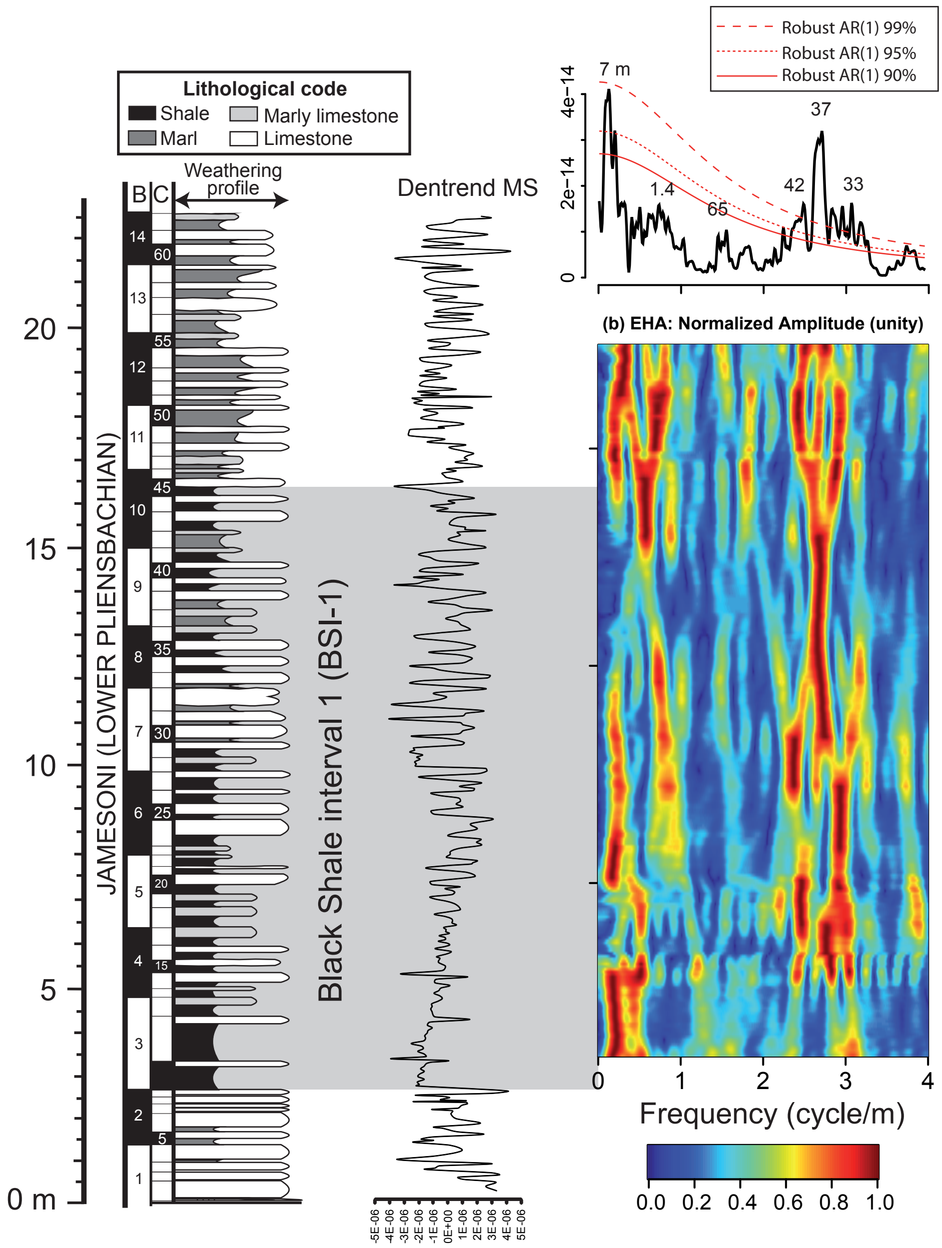


Figure S4. Stratigraphic log and chronostratigraphy of the studied section, showing the detrended MS curve. Bundles (B) and couplets (C) identified in the sedimentary alternation are numbered in ascending stratigraphic order. The 2π-MTM and EHA spectra of the MS data series are presented.

Limestones usually present higher magnetic susceptibility values than adjacent marls/shales. However, the MS data series displays a greater dispersion and a spikier appearance than the colour and %$CaCO_3$ data series, which very likely explains the low correlation coefficient between the MS data series and the colour and %$CaCO_3$ data series (Fig. S2). The MS signal is mainly carried by magnetite content (Fig.S3), which could be either detrital in origin or related to postdepositional changes in redox state. The influence of early diagenetic processes, such as partial replacement of pyrite with iron oxides at more oxygenated conditions, might explain the high variability of the MS curve. Notwithstanding the potential flaws of the MS data series, the spectral analysis shows that it records a significant periodicity with an average thickness equivalent to that of precession couplets. Despite being less prominent, cycles correlatable with those attributed to obliquity(?), short eccentricity (bundles) and long eccentricity in the colour spectral analysis series can also be identified in the MS spectra.



Figures S5. A) Bulk stable isotope composition of the Santiurde succession. Note that samples are organized following the normal diagenetic trend controlled by local carbonate dissolution and reprecipitation during burial. B) Crossplot of $\delta^{13}C_{carb}$ and $\%CaCO_3$ content of the interval studied in detail (limestone and marly limestone samples: white dots; marl and shale samples: black dots).

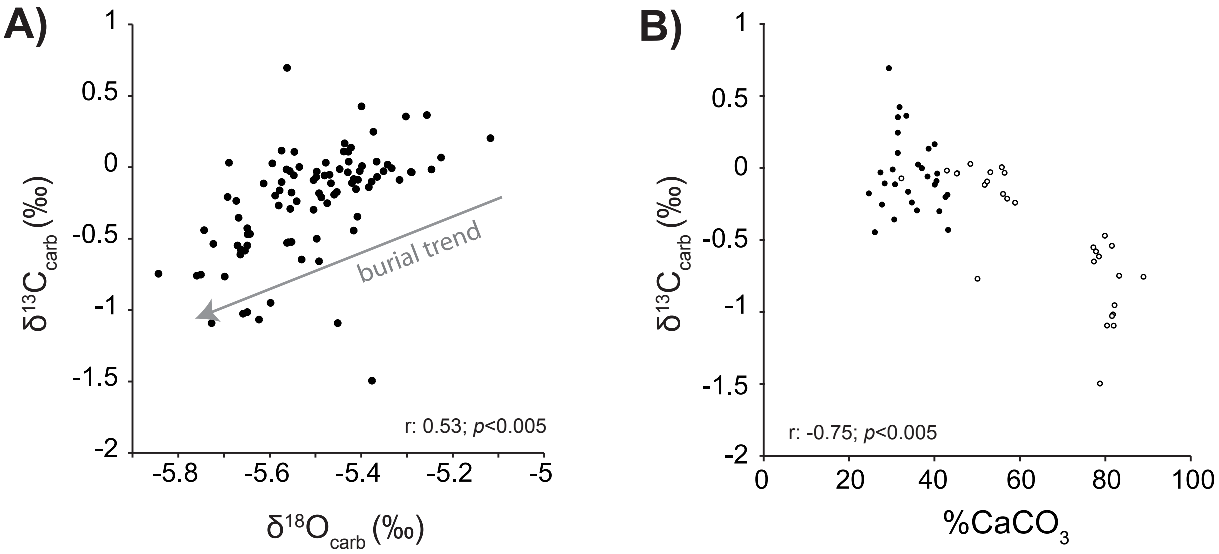


Figure S6. Crossplots between several diagenetic sensitive elements (Fe, Mn, Sr and $^{18}O_{carb}$).

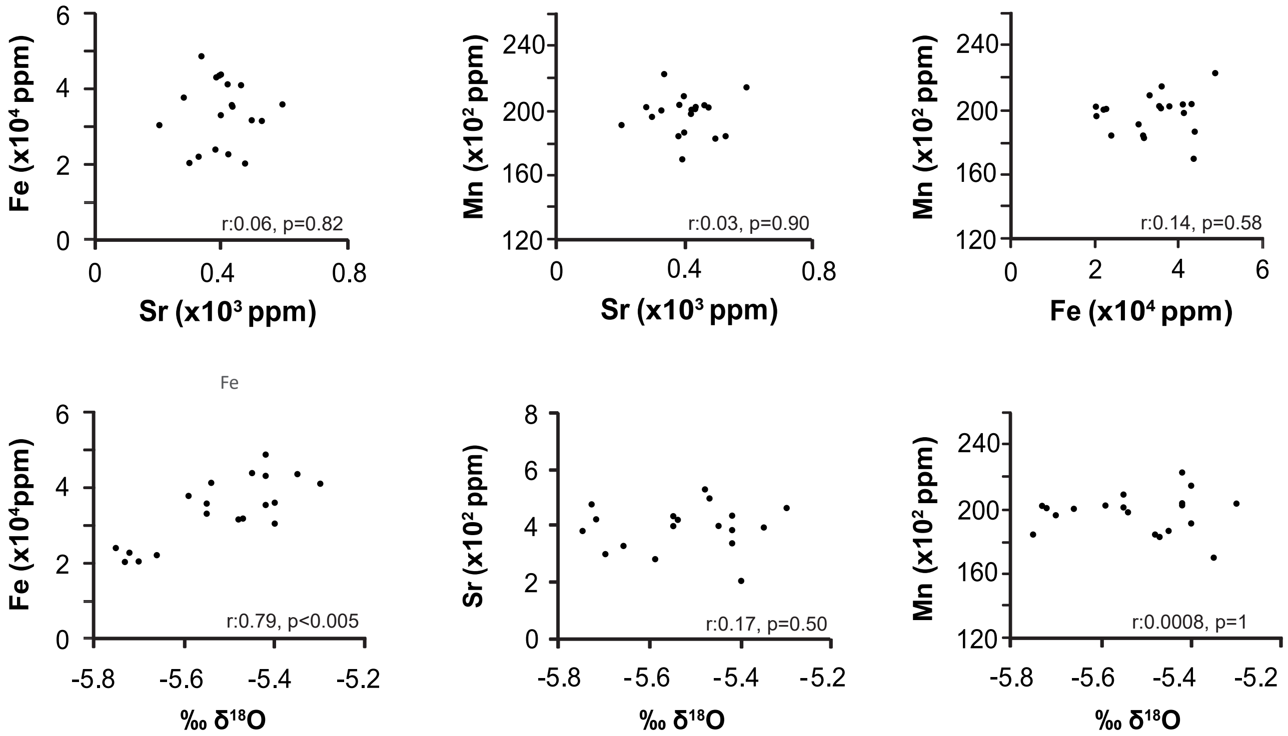


Table S1. Stratigraphic location of the Santiurde samples and their mass-normalized low-field magnetic susceptibility (MS) and colours (mean RGB) values.

Stratigraphic level (m)	Sample Label	Normalized Ms (m3/kg)	Colour (mean RGB)
0.17	ST99	1.67442E-05	138.99
0.27	ST100	1.5824E-05	137.081
0.37	ST101	1.63145E-05	133.206
0.43	ST102	1.40087E-05	130.76
0.48	ST103	1.35599E-05	146.978
0.53	ST104	1.62909E-05	145.736
0.58	ST105	1.56725E-05	152.26
0.63	ST106	1.25637E-05	137.437
0.66	ST107	1.10402E-05	137.996
0.69	ST108	1.16674E-05	150.653
0.74	ST109	1.19349E-05	150.601
0.79	ST110	1.53759E-05	158.476
0.85	ST111	1.0282E-05	139.377
0.89	ST112	8.77446E-06	121.155
0.97	ST113	1.14479E-05	142.776
1.09	ST114	1.29006E-05	146.484
1.21	ST115	1.19065E-05	143.122
1.28	ST116	9.27092E-06	135.905
1.32	ST117	1.0636E-05	77.076
1.35	ST118	9.71365E-06	121.982
1.4	ST119	1.04224E-05	121.994
1.46	ST120	1.37901E-05	136.69
1.52	ST121	1.19297E-05	152.407
1.57	ST122	1.11972E-05	138.032
1.6	ST123	1.08411E-05	134.172
1.63	ST124	1.02444E-05	88.85
1.71	ST125	1.31528E-05	136.667
1.82	ST126	1.14434E-05	142.014
1.93	ST127	1.08706E-05	140.868
2	ST128	1.08632E-05	113.397
2.03	ST129	9.45017E-06	130.765
2.06	ST130	1.12191E-05	118.475
2.1	ST131	1.13269E-05	115.795
2.13	ST132	1.139E-05	114.045
2.16	ST133	1.17406E-05	125.946
2.19	ST134	1.15517E-05	115.138
2.21	ST135	7.94355E-06	107.688
2.23	ST136	1.15176E-05	no data
2.25	ST137	9.75741E-06	97.151
2.3	ST138	1.0324E-05	91.159
2.33	ST139	9.77143E-06	87.5
2.36	ST140	7.97792E-06	86.845
2.4	ST141	1.30297E-05	125.475
2.45	ST142	1.40977E-05	125.018
2.5	ST143	1.17973E-05	105.376
2.57	ST144	7.66919E-06	74.267
2.6	ST145	7.8318E-06	74.381
2.66	ST146	7.61717E-06	79.095
2.72	ST147	8.00354E-06	79.64
2.78	ST148	7.51443E-06	74.741
2.84	ST149	7.54457E-06	76.958

2.9	ST150	7.7758E-06	72.247
2.96	ST151	7.46452E-06	82.71
3.02	ST152	7.61998E-06	87.29
3.08	ST153	7.70374E-06	88.963
3.11	ST154	7.96278E-06	105.022
3.15	ST155	9.04677E-06	103.19
3.19	ST156	5.14505E-06	117.398
3.24	ST157	7.46569E-06	76.518
3.3	ST158	7.27616E-06	79.128
3.36	ST159	6.78114E-06	77.547
3.42	ST160	7.07834E-06	75.285
3.48	ST161	6.89781E-06	77.862
3.54	ST162	6.12822E-06	73.574
3.6	ST163	6.90624E-06	75.942
3.66	ST164	6.97805E-06	74.878
3.72	ST165	6.87322E-06	82.012
3.78	ST166	7.01549E-06	86.408
3.84	ST167	7.05331E-06	80.169
3.9	ST168	7.30004E-06	78.327
3.96	ST169	6.95972E-06	77.523
4.03	ST170	7.0984E-06	100.508
4.09	ST171	9.78964E-06	111.107
4.15	ST172	7.40183E-06	99.022
4.21	ST173	7.23596E-06	79.952
4.27	ST174	7.18182E-06	77.786
4.33	ST175	7.07744E-06	78.835
4.39	ST176	7.17207E-06	80.258
4.45	ST177	7.14103E-06	83.012
4.51	ST178	7.57382E-06	84.048
4.57	ST179	7.85471E-06	84.834
4.63	ST180	7.69114E-06	79.104
4.69	ST181	7.25102E-06	79.565
4.75	ST182	7.57999E-06	80.9
4.81	ST183	7.7201E-06	83.913
4.87	ST184	8.33228E-06	83.611
4.93	ST185	7.33936E-06	80.676
5.01	ST186	7.44357E-06	102.363
5.07	ST187	9.56652E-06	117.983
5.13	ST188	5.0797E-06	107.729
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5.31	ST2	8.18208E-06	91.896
5.4	ST3	7.74231E-06	86.796
5.49	ST4	7.89123E-06	106.569
5.53	ST5	7.6837E-06	108.867
5.6	ST6	8.4713E-06	78.804
5.65	ST7	8.70157E-06	81.74
5.71	ST8	7.66247E-06	70.821
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5.8	ST10	8.71512E-06	105.015
5.84	ST11	8.55031E-06	106.704
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7	ST35	9.8878E-06	91.912
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14.42	ST21M4	9.02189E-06	82.293
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14.59	ST21L4	9.96197E-06	130.698
14.67	ST22MA2	9.32953E-06	94.412
14.74	ST22MA4	8.53489E-06	78.651
14.81	ST22MA5	9.66145E-06	74.388
14.86	ST22LA2	1.22212E-05	100.578
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14.92	ST22LA4	1.29555E-05	96.336
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15.08	ST22MB5	1.0528E-05	87.358
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15.5	ST22MC3	no data	88.811
15.55	ST22LC1	no data	117.445
15.58	ST22LC2	1.10233E-05	128.805
15.66	ST22LC3	1.36293E-05	132.062
15.73	ST22LC4	9.63581E-06	136.777
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15.85	241	9.10531E-06	83.815
15.91	242	1.07087E-05	80.945
15.97	243	1.03059E-05	106.976
16.02	244	1.19769E-05	111.713
16.07	245	1.12663E-05	105.761
16.14	246	9.73822E-06	87.226
16.22	247	8.64768E-06	79.015
16.3	248	6.4875E-06	77.376
16.35	249	9.0188E-06	81.829
16.4	250	1.10888E-05	112.454

16.45	251	1.08155E-05	114.033
16.5	252	1.00186E-05	93.459
16.55	253	9.81145E-06	83.411
16.6	254	9.68022E-06	80.324
16.65	255	1.05962E-05	84.825
16.7	256	1.00006E-05	80.944
16.75	257	1.2269E-05	86.286
16.8	258	1.17738E-05	86.618
16.85	259	1.05164E-05	82.71
16.9	260	1.13241E-05	80.845
16.95	261	1.10792E-05	81.754
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18.12	ST279	1.11452E-05	120.122
18.16	ST280	8.18408E-06	106.191
18.21	ST281	7.43684E-06	131.074
18.26	ST282	7.98852E-06	136.491
18.32	ST283	7.36964E-06	123.721
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18.7	ST290	8.09692E-06	145.393
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18.83	ST292	7.86432E-06	104.158
18.88	ST293	9.21539E-06	138.488
18.94	ST294	8.22598E-06	137.03
19.01	ST295	9.40489E-06	139.943
19.08	ST296	1.00384E-05	121.654
19.16	ST297	8.08786E-06	104.215
19.24	ST298	7.93829E-06	100.848
19.31	ST299	1.08363E-05	135.918
19.38	ST300	1.1977E-05	142.815
19.45	ST301	8.61761E-06	138.217
19.52	ST302	9.79555E-06	148.616
19.58	ST303	1.00304E-05	105.657
19.64	ST304	8.5068E-06	84.758
19.71	ST305	1.0782E-05	100.607

19.78	ST306	1.26806E-05	122.273
19.87	ST307	1.18391E-05	113.48
19.95	ST308	8.68172E-06	88.704
20.03	ST309	8.42959E-06	81.464
20.11	ST310	1.1565E-05	127.869
20.19	ST311	9.0031E-06	139.74
20.24	ST312	1.16767E-05	131.266
20.27	ST313	1.02706E-05	102.468
20.3	ST314	9.10602E-06	82.365
20.37	ST315	1.02091E-05	145.283
20.46	ST316	1.23915E-05	158.989
20.55	ST317	9.06889E-06	147.858
20.63	ST318	1.06683E-05	122.359
20.7	ST319	8.84106E-06	90.673
20.77	ST320	8.47331E-06	89.228
20.83	ST321	9.28094E-06	95.702
20.88	ST322	1.21715E-05	127.544
20.93	ST323	1.05003E-05	114.968
21.01	ST324	9.09551E-06	101.088
21.1	ST325	8.57903E-06	84.141
21.19	ST326	9.14246E-06	80.179
21.26	ST327	1.1917E-05	102.259
21.3	ST328	8.46159E-06	139.61
21.34	ST329	1.10946E-05	123.08
21.39	ST330	9.67204E-06	90.013
21.46	ST331	7.9265E-06	75.234
21.53	ST332	6.81239E-06	76.673
21.61	ST333	1.16855E-05	140.002
21.69	ST334	1.45418E-05	147.725
21.78	ST335	8.59826E-06	137.585
21.84	ST336	1.13629E-05	102.931
21.89	ST337	9.75887E-06	91.144
21.94	ST338	8.72187E-06	72.726
22	ST339	1.10461E-05	89.264
22.06	ST340	1.30876E-05	84.428
22.11	ST341	1.17539E-05	110.752
22.19	ST342	9.23814E-06	82.476
22.26	ST343	9.01362E-06	81.369
22.33	ST344	1.06887E-05	84.002
22.4	ST345	1.11698E-05	84.704
22.44	ST346	1.34191E-05	109.739
22.48	ST347	1.28092E-05	110.236

Table S2. Bed thickness and limestone-marl thickness ratio of each couplet of the Santiurde interval studied in detail. Stratigraphic location of the samples and their whole-rock mineralogy and organic geochemistry

Bed	Strat high (m)	Bed thickness (cm)	L/M ratio	Whole-rock mineralogy						Organic geochemistry			
				%Quartz	**%Clays**	**%Calcite**	**%Gypsum**	**%Dolomite**	**%Pyrite**	% N_{org}	$\delta^{15}N_{org}$ (‰)	% C_{org}	$\delta^{13}C_{org}$(‰)
ST 18M	12.5	20		13	41	36	1	0	9	0.07	2.63	1.94	-28.90
ST 18L	12.69	19	0.95	5	9	83	0	0	3	0.02	2.05	0.38	-27.79
ST 18AM	12.88	19		13	44	33	1	0	9	0.09	3.09	2.86	-29.00
ST 18AL	13.07	19	1.00	9	32	57	0	0	2	0.06	1.69	2.78	-28.74
ST 18BM	13.27	20		10	35	45	1	0.5	9	0.08	2.76	3.30	-29.17
ST 18BL	13.46	19	0.95	9	25	61	0	1	4	0.05	2.00	1.63	-28.29
ST 19M	13.65	20		11	40	44	1	0	4	0.07	2.90	2.84	-29.27
ST 19L	13.87	23	1.15	3	11	84	0	0	2	0.02	1.05	0.30	-27.64
ST 20M	14.04	11		12	50	28	0	4	6	0.09	3.11	2.54	-29.14
ST 20L	14.17	15	1.36	3	13	82	0	0	2	0.02	2.44	0.26	-27.22
ST 21M	14.35	21		12	45	32	1	2	8	0.09	3.18	3.41	-29.56
ST 21L	14.54	17	0.81	4	15	79	0	0	2	0.02	2.78	0.30	-27.68
ST 21AM	14.74	22		10	37	44	0.5	2	7	0.08	3.21	4.03	-29.48
ST 21AL	14.89	8	0.36	10	29	55	0	2	4	0.04	1.90	1.00	-27.78
ST 21BM	15.08	30		9	43	48	0.5	0	0.5	0.07	2.95	2.30	-28.91
ST 21BL	15.28	10	0.33	10	30	54	0	2	4	0.04	2.07	1.02	-28.03
ST 22M	15.43	20		10	47	38	0	2	3	0.07	2.80	2.35	-29.21
ST 22L	15.73	23	1.15	3	14	81	0	0	2	0.02	1.96	0.37	-27.95
ST 22AM	15.85	19		12	48	36	0	0	4	0.08	2.96	2.58	-29.05

Table S3. Stratigraphic location of the Santiurde samples and their %$CaCO_3$, $\delta^{13}C_{carb}$ and $\delta^{18}C_{carb}$ values.

Strat general (m)	Sample code	CaCO3 (%)	$\delta^{13}C_{carb}$ (‰)	$\delta^{18}O_{carb}$ (‰)
12.44	ST18M2	41.14	-0.298	-5.504
12.5	ST18M3	27.35	-0.029	-5.351
12.56	ST18M4	29.33	0.696	-5.562
12.63	ST18L2	78.76	-1.495	-5.376
12.69	ST18L3	88.97	-0.753	-5.75
12.75	ST18L4	77.84	-0.577	-5.663
12.82	ST19MA2	30.6	-0.355	-5.668
12.88	ST19MA3	24.63	-0.174	-5.453
12.94	ST19MA4	28.33	-0.105	-5.574
13.01	ST19LA2	32.26	-0.07	-5.498
13.07	ST19LA3	48.41	0.031	-5.477
13.13	ST19LA4	42.91	-0.016	-5.246
13.2	ST19MB2	34.69	-0.237	-5.673
13.27	ST19MB3	37.07	0.001	-5.535
13.34	ST19MB4	38.37	-0.057	-5.547
13.4	ST19LB2	56.42	-0.031	-5.497
13.46	ST19LB3	55.78	0.008	-5.398
13.52	ST19LB4	57.05	-0.211	-5.487
13.59	ST19CM2	43.05	-0.183	-5.492
13.65	ST19CM3	36.17	0.026	-5.594
13.71	ST19CM4	45.33	-0.034	-5.291
13.79	ST19LC2	50.09	-0.767	-5.698
13.87	ST19LC3	81.97	-1.093	-5.451
13.95	ST19LC4	78.53	-0.612	-5.664
14.01	ST20M1	35.91	-0.292	-5.555
14.04	ST20M2	26.05	-0.444	-5.416
14.07	ST20M3	40.47	-0.088	-5.407
14.12	ST20L2	81.83	-1.015	-5.649
14.17	ST20L3	81.59	-1.026	-5.658
14.22	ST20L4	77.23	-0.549	-5.649
14.28	ST21M2	33.83	-0.163	-5.578
14.35	ST21M3	27.72	-0.252	-5.474
14.42	ST21M4	43.21	-0.428	-5.649
14.49	ST21L2	77.36	-0.647	-5.53
14.54	ST21L3	81.56	-0.538	-5.723
14.59	ST21L4	79.92	-0.468	-5.643
14.67	ST22MA2	30.78	-0.111	-5.42
14.74	ST22MA4	30.2	-0.008	-5.333
14.81	ST22MA5	42.58	-0.199	-5.588
14.86	ST22LA2	51.77	-0.115	-5.613
14.89	ST22LA3	53.1	-0.027	-5.403
14.92	ST22LA4	52.34	-0.091	-5.504
14.98	ST22MB3	40.04	0.167	-5.436

15.08	ST22MB5	38.64	0.137	-5.422
15.18	ST22MB7	40.07	-0.113	-5.466
15.25	ST22LB2	58.89	-0.239	-5.541
15.28	ST22LB3	56.07	-0.178	-5.552
15.31	ST22LB4	45.23	-0.036	-5.429
15.36	ST22MC1	31.83	0.425	-5.399
15.43	ST22MC2	31.41	0.107	-5.546
15.5	ST22MC3	40.66	-0.036	-5.289
15.58	ST22LC2	83.26	-0.746	-5.843
15.66	ST22LC3	82.17	-0.951	-5.598
15.73	ST22LC4	80.43	-1.092	-5.727
15.79	ST22AM2	31.42	0.248	-5.373
15.85	ST22AM3	31.45	0.355	-5.302
15.91	ST22AM4	33.41	0.365	-5.256

Table S4. Stratigraphic location of the Santiurde samples and their major and trace element content

Bed	Strat high (m)	SiO_2	TiO_2	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO	Na_2O	P_2O_5	LOI	Co	Cr	Cu	Ni	Sr	V	Zn
		%	%	%	%	%	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
ST 18M	12.5	31.63	0.54	14.07	19.43	6.23	3.33	1.53	0.02	0.66	0.13	22.9	11.0	78.3	88.4	62.0	392	156	981
ST 18L	12.69	9.39	0.18	5.41	44.50	3.42	0.36	0.98	0.02	0.15	0.05	35.4	2.44	31.5	26.5	10.7	380	35.0	11.5
ST 18AM	12.88	32.98	0.60	15.25	15.73	6.27	3.87	1.91	0.02	0.52	0.12	22.9	11.3	99.3	68.7	67.7	398	206	298
ST 18AL	13.07	22.43	0.38	11.81	27.99	4.51	1.93	1.58	0.02	0.43	0.07	28.7	5.27	86.3	34.0	29.9	527	115	34.3
ST 18BM	13.27	25.14	0.47	13.02	23.51	5.90	2.89	1.82	0.03	0.46	0.11	27.2	8.99	79.7	66.8	83.8	419	235	1058
ST 18BL	13.46	21.16	0.34	8.66	31.93	4.35	1.62	1.65	0.02	0.46	0.07	29.5	6.27	81.6	53.9	37.8	203	101	36.5
ST 19M	13.65	29.30	0.51	11.81	22.79	5.40	2.88	1.79	0.03	0.67	0.11	25.5	10.5	92.4	76.9	86.2	280	247	319
ST 19L	13.87	7.67	0.16	4.83	46.19	2.92	0.48	1.08	0.03	0.17	0.04	36.8	2.78	29.4	27.3	16.8	298	45.1	12.7
ST 20M	14.04	34.77	0.68	13.97	14.73	6.97	3.79	2.42	0.03	0.56	0.17	21.3	13.9	103	87.1	71.0	336	219	281
ST 20L	14.17	8.02	0.18	5.34	46.34	3.16	0.37	1.08	0.03	0.14	0.04	36.2	3.29	30.6	17.3	15.1	327	37.8	12.3
ST 21M	14.35	2.70	0.02	0.52	68.97	0.30	0.10	3.70	0.01	0.05	0.03	24.3	<LMD	8.4	8.08	9.28	684	9.8	34.7
ST 21L	14.54	8.89	0.18	5.64	44.72	3.25	0.35	1.15	0.03	0.17	0.06	35.6	3.02	33.0	21.6	13.4	421	47.6	15.7
ST 21AM	14.74	25.56	0.44	11.49	23.40	6.16	2.57	1.75	0.03	0.58	0.12	27.6	9.08	87.7	94.4	97.7	383	240	358
ST 21AL	14.89	22.26	0.38	11.21	29.34	5.14	1.89	1.85	0.03	0.45	0.08	27.5	5.67	73.3	42.0	24.8	592	85.3	36.4
ST 21BM	15.08	26.17	0.46	12.56	23.99	5.06	2.87	1.72	0.03	0.48	0.11	26.0	8.29	88.1	56.4	43.2	434	134	50.5
ST 21BL	15.28	22.10	0.37	9.73	31.42	4.73	1.59	1.84	0.03	0.45	0.08	28.5	5.78	68.5	36.2	26.1	397	78.9	36.6
ST 22M	15.43	29.22	0.51	12.76	21.18	5.11	2.95	1.85	0.03	0.65	0.12	25.1	8.99	86.4	64.1	49.9	432	168	484
ST 22L	15.73	8.38	0.17	5.32	46.17	2.90	0.34	1.05	0.03	0.15	0.09	36.4	2.54	35.5	18.4	13.1	474	41.7	15.1
ST 22AM	15.85	32.41	0.55	14.11	17.61	5.86	3.56	1.83	0.03	0.56	0.12	22.8	9.68	96.1	61.0	51.2	461	187	70.5
LMD (ppb)		774	0.90	11.3	188	18.5	112	2.15	0.07	15.2	64.4		1.40	2.92	57.0	44.6	1.30	1.17	5.94
BCR-2 mean (n=4)		94	100	99	101	98	102	97	101	104	84		106	107	93	85	107	105	105
ERROR		0.03	0.05	0.05	0.04	0.04	0.06	0.05	0.04	0.04	0.04		0.05	0.05	0.34	0.41	0.05	0.05	0.05

Bed	Strat high (m)	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
ST 18M	12.5	38.4	62.9	7.62	27.0	4.93	0.97	4.41	0.66	3.82	0.64	2.16	0.38	2.38	0.43
ST 18L	12.69	20.4	35.6	4.85	20.2	4.15	0.82	3.88	0.58	3.21	0.52	1.70	0.28	1.59	0.28
ST 18AM	12.88	47.0	76.6	9.33	31.8	5.38	0.97	4.92	0.73	4.19	0.71	2.45	0.45	2.79	0.49
ST 18AL	13.07	29.5	51.9	6.78	26.7	5.27	1.03	4.87	0.73	4.18	0.69	2.26	0.38	2.28	0.40
ST 18BM	13.27	35.4	60.5	7.62	28.7	5.42	0.98	4.91	0.74	4.24	0.69	2.32	0.40	2.45	0.43
ST 18BL	13.46	19.8	32.5	4.31	16.7	3.25	0.70	2.91	0.44	2.47	0.41	1.36	0.23	1.40	0.24
ST 19M	13.65	13.9	22.1	3.01	12.4	2.49	0.52	2.37	0.36	2.04	0.33	1.09	0.18	1.04	0.18
ST 19L	13.87	35.7	55.4	6.67	22.9	3.98	0.81	3.75	0.54	3.14	0.52	1.82	0.32	1.98	0.35
ST 20M	14.04	17.7	29.1	3.97	16.4	3.30	0.65	3.08	0.46	2.62	0.44	1.44	0.23	1.35	0.24
ST 20L	14.17	21.7	37.1	4.54	16.7	3.19	0.63	2.89	0.44	2.57	0.43	1.47	0.26	1.58	0.28
ST 21M	14.35	33.4	55.7	7.52	31.0	6.38	1.28	5.93	0.92	5.23	0.86	2.78	0.46	2.69	0.48
ST 21L	14.54	28.7	52.0	6.97	27.5	5.52	1.06	4.96	0.77	4.39	0.71	2.34	0.40	2.36	0.41
ST 21AM	14.74	18.7	33.7	4.30	17.1	3.43	0.64	3.18	0.47	2.71	0.45	1.46	0.25	1.47	0.26
ST 21AL	14.89	39.8	68.6	8.65	32.6	6.19	1.20	5.63	0.85	4.85	0.80	2.69	0.46	2.87	0.50
ST 21BM	15.08	29.7	52.6	7.04	28.1	5.60	1.11	4.90	0.75	4.24	0.69	2.30	0.39	2.37	0.41
ST 21BL	15.28	33.1	55.1	6.81	24.5	4.42	0.87	4.00	0.60	3.49	0.58	1.97	0.35	2.12	0.37
ST 22M	15.43	16.2	27.3	3.86	16.4	3.43	0.74	3.26	0.49	2.73	0.45	1.42	0.23	1.34	0.24
ST 22L	15.73	40.3	66.9	8.14	28.4	4.93	0.92	4.47	0.67	3.86	0.65	2.26	0.40	2.45	0.43
ST 22AM	15.85	34.1	57.1	7.05	25.5	4.57	0.88	4.21	0.63	3.69	0.61	2.07	0.36	2.23	0.39
LMD (ppb)		0.14	0.07	0.01	0.09	0.02	0.01	0.02	0.005	0.034	0.004	0.014	0.004	0.014	0.003
BCR-2 mean (n=4)		103	103	107	109	106	101	95	100	97	96	95	101	94	108
ERROR		0.05	0.05	0.05	0.04	0.06	0.06	0.03	0.04	0.04	0.05	0.04	0.03	0.03	0.03

Table S5. Factor matrix containing the rotated factor loadings, which are equivalent to the correlation between the variable and the factor. The amount of total variance explained by each factor is also represented. Values in bold exceed 0.65; values in bold and italics are between 0.50 and 0.64.

Rotated Component Matrix

	Factor			
	1	2	3	4
% of variance	44.54	25.78	9.92	7.73
Cumulative %	44.54	70.32	80.24	87.97
Ni	**0.88**	0.33	-0.14	0.12
Co	**0.88**	0.33	-0.01	0.00
Cu	**0.87**	0.37	-0.12	0.12
P_2O_5	**0.84**	0.40	0.06	-0.15
V	**0.83**	0.49	-0.11	0.02
%piryte	**0.79**	0.09	0.11	0.42
%$C_{org.}$	**0,70**	***0.59***	-0.03	0.08
%clays	**0.66**	**0.71**	0.06	-0.14
Zn	***0.64***	0.20	0.04	***0.50***
Al_2O_3	***0.59***	**0.74**	0.18	0.01
Na_2O	0.43	**0.84**	-0.13	0.02
$\delta^{13}C_{carb}$	0.17	**0.95**	0.08	0.09
Sr	0.04	0.12	**0.89**	-0.13
MnO	0.00	0.01	0.01	**-0.91**
Ba	-0.18	-0.07	**0.91**	0.16
%calcite	**-0.73**	**-0.65**	-0.07	0.05
$\delta^{13}C_{org}$	**-0.74**	***-0.60***	0.09	-0.08
MS	**-0.84**	-0.19	0.16	0.05