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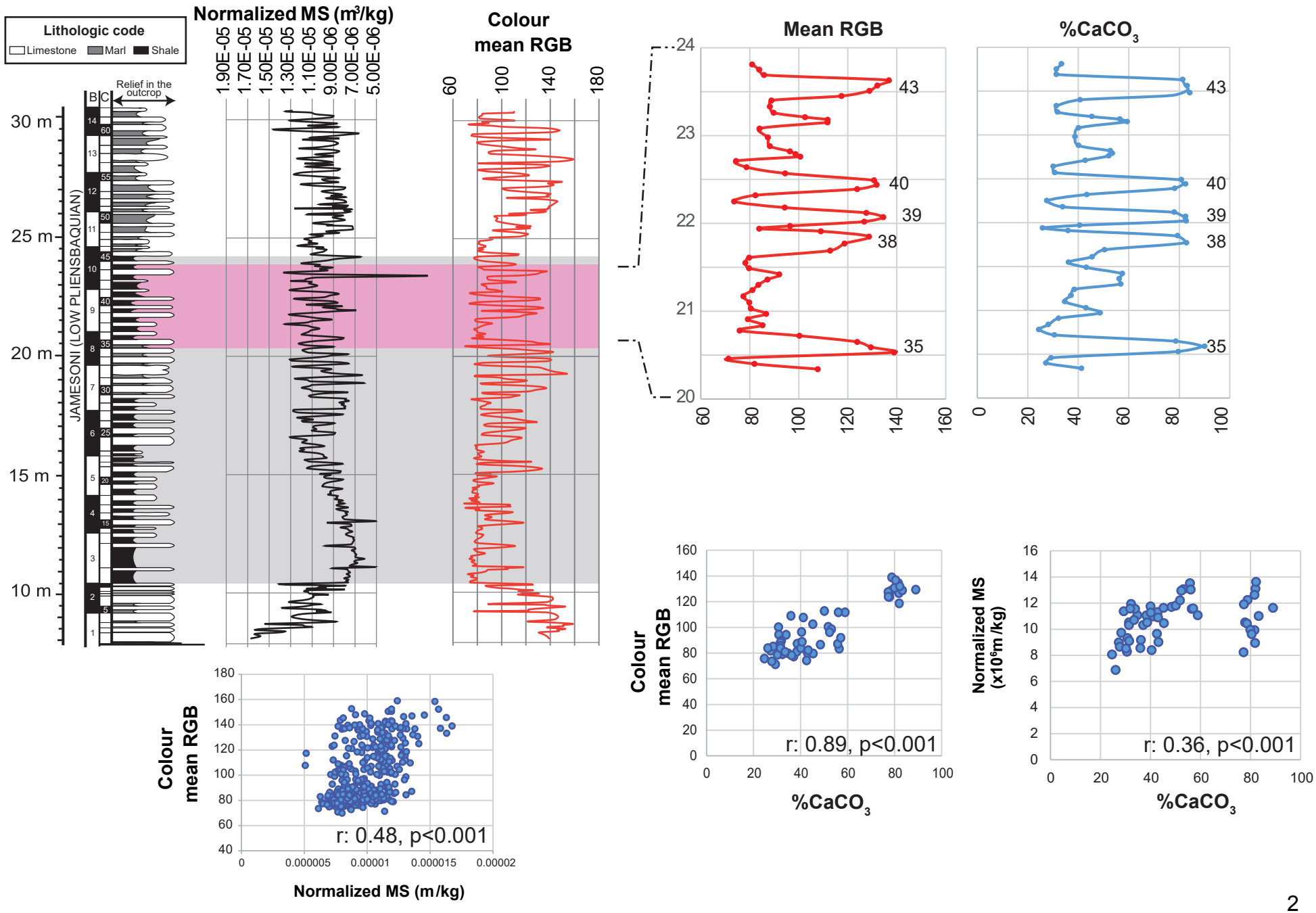
Figure S1. Stratigraphic log and chronostratigraphy of the studied section, showing the MS and colour data curves. Bundles (B) and couplets (C) identified in the sedimentary alternation are numbered in ascending stratigraphic order. The grey background shows the extent of the Uptonia jamesoni Black Shale 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.



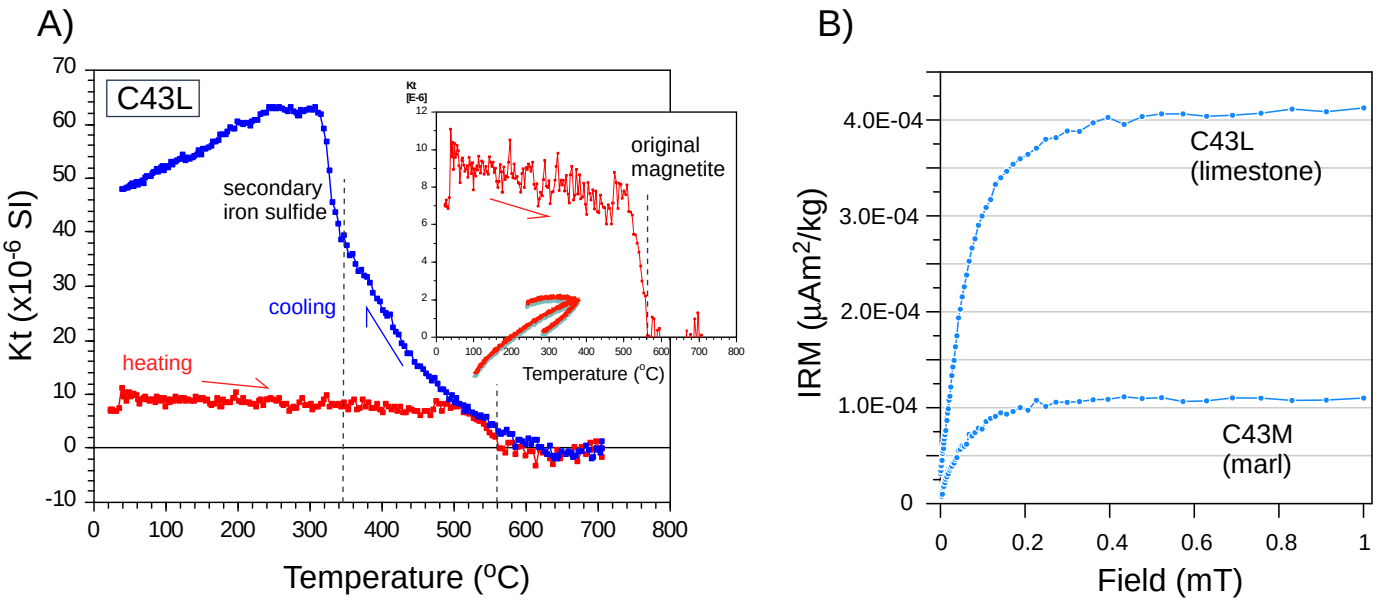


Figure S2. A) Thermomagnetic curve of a limestone sample (C43L) indicating the presence of a original ferromagnetic phase (magnetite). Secondary magnetic iron sulfides (pirrotite?) are created upon heating the sample up to 700ºC as inferred from the cooling curve. B) Isothermal remanent magnetization (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.

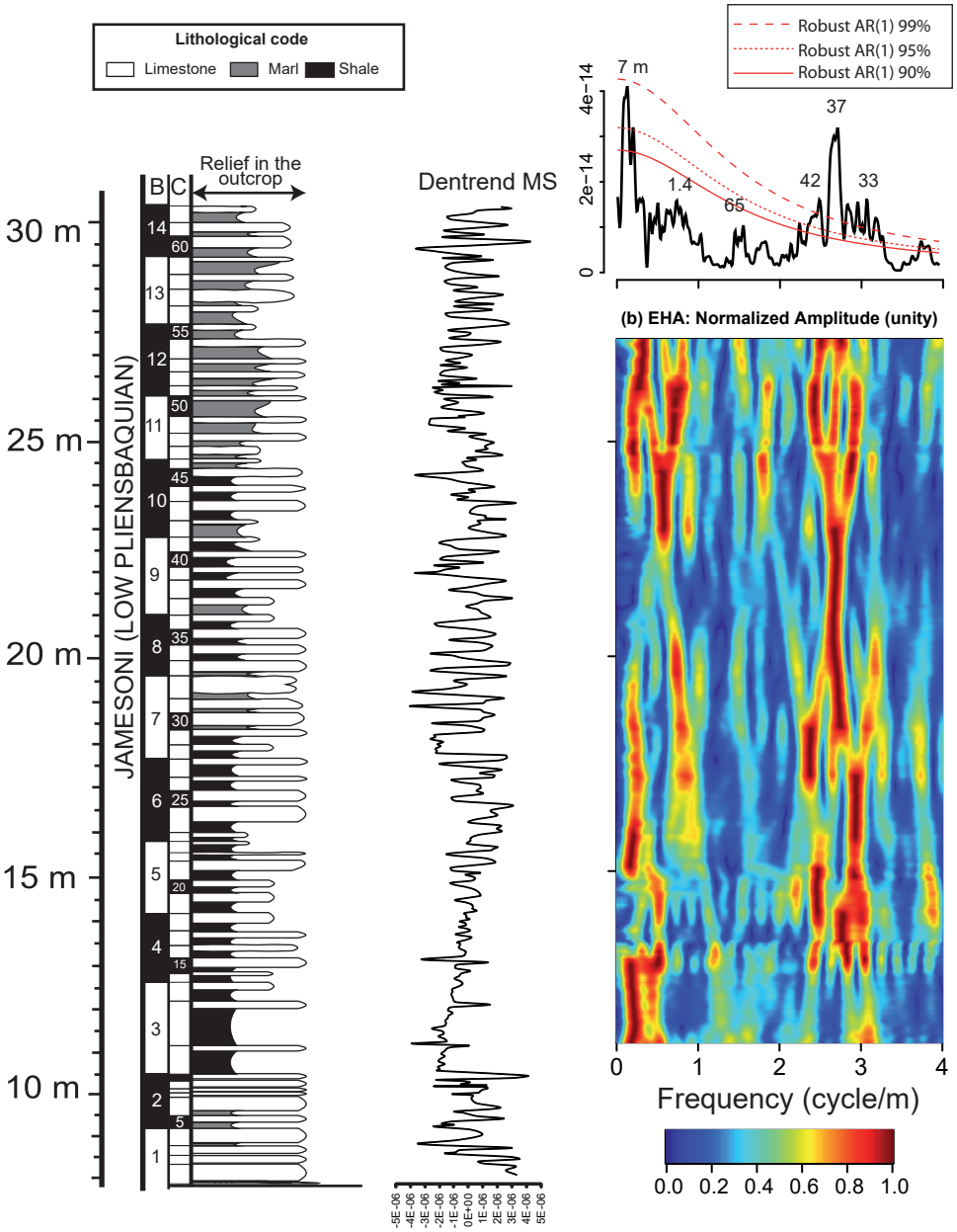
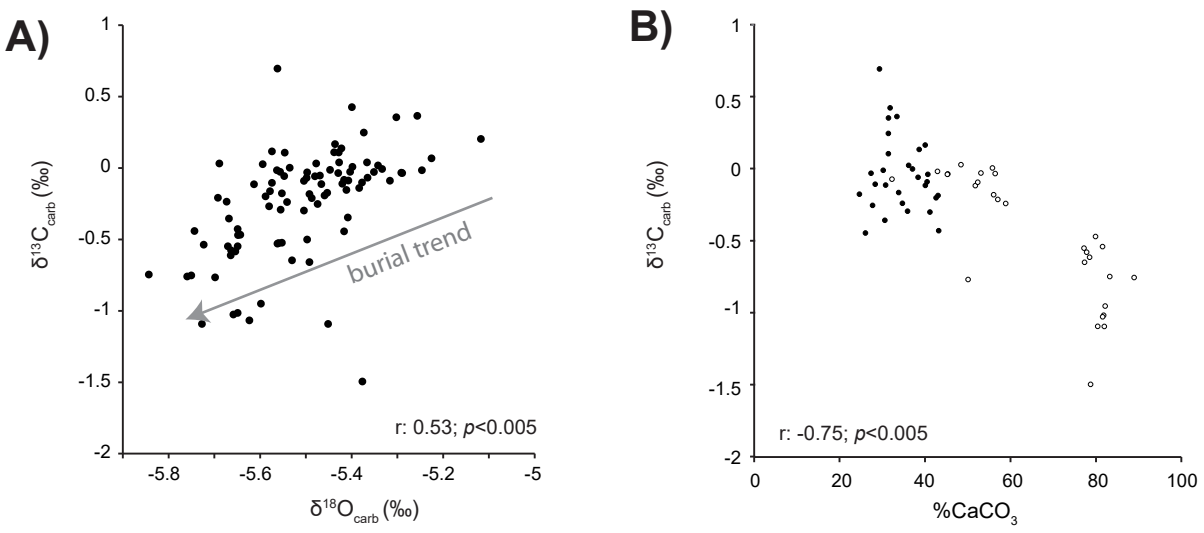


Figure S3. Stratigraphic log and chronostratigraphy of the studied section, showing the detrended MS curve. Bundles (B) and couplets (C) identified in the sedimentary alternation are numbered in ascending stratigraphic order. The 2π-MTM and EHA spectra of the MS data series are presented.



Figures S4. 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).

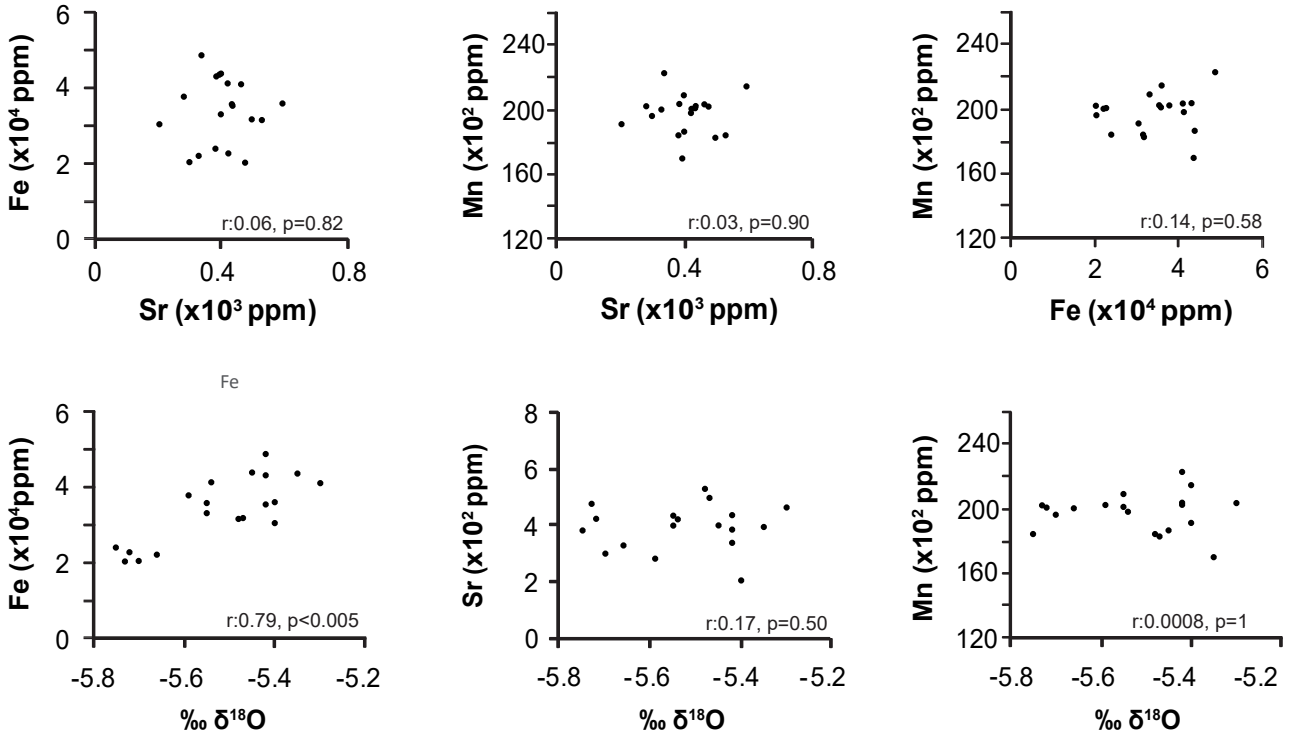


Figure S5. Crossplots between several diagenetic sensitive elements (Fe, Mn, Sr and $^{18}O_{carb}$).

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

Stratigraphic level (m)	Sample Label	Normalized Ms (m3/kg)	Colour (mean RGB)
8.07	ST99	1.67442E-05	138.99
8.17	ST100	1.5824E-05	137.081
8.27	ST101	1.63145E-05	133.206
8.33	ST102	1.40087E-05	130.76
8.38	ST103	1.35599E-05	146.978
8.43	ST104	1.62909E-05	145.736
8.48	ST105	1.56725E-05	152.26
8.53	ST106	1.25637E-05	137.437
8.56	ST107	1.10402E-05	137.996
8.59	ST108	1.16674E-05	150.653
8.64	ST109	1.19349E-05	150.601
8.69	ST110	1.53759E-05	158.476
8.75	ST111	1.0282E-05	139.377
8.79	ST112	8.77446E-06	121.155
8.87	ST113	1.14479E-05	142.776
8.99	ST114	1.29006E-05	146.484
9.11	ST115	1.19065E-05	143.122
9.18	ST116	9.27092E-06	135.905
9.22	ST117	1.0636E-05	77.076
9.25	ST118	9.71365E-06	121.982
9.3	ST119	1.04224E-05	121.994
9.36	ST120	1.37901E-05	136.69
9.42	ST121	1.19297E-05	152.407
9.47	ST122	1.11972E-05	138.032
9.5	ST123	1.08411E-05	134.172
9.53	ST124	1.02444E-05	88.85
9.61	ST125	1.31528E-05	136.667
9.72	ST126	1.14434E-05	142.014
9.83	ST127	1.08706E-05	140.868
9.9	ST128	1.08632E-05	113.397
9.93	ST129	9.45017E-06	130.765
9.96	ST130	1.12191E-05	118.475
10	ST131	1.13269E-05	115.795
10.03	ST132	1.139E-05	114.045
10.06	ST133	1.17406E-05	125.946
10.09	ST134	1.15517E-05	115.138
10.11	ST135	7.94355E-06	107.688
10.13	ST136	1.15176E-05	no data
10.15	ST137	9.75741E-06	97.151
10.2	ST138	1.0324E-05	91.159
10.23	ST139	9.77143E-06	87.5
10.26	ST140	7.97792E-06	86.845
10.3	ST141	1.30297E-05	125.475
10.35	ST142	1.40977E-05	125.018
10.4	ST143	1.17973E-05	105.376
10.47	ST144	7.66919E-06	74.267
10.5	ST145	7.8318E-06	74.381
10.56	ST146	7.61717E-06	79.095
10.62	ST147	8.00354E-06	79.64
10.68	ST148	7.51443E-06	74.741
10.74	ST149	7.54457E-06	76.958
10.8	ST150	7.7758E-06	72.247
10.86	ST151	7.46452E-06	82.71
10.92	ST152	7.61998E-06	87.29
10.98	ST153	7.70374E-06	88.963
11.01	ST154	7.96278E-06	105.022
11.05	ST155	9.04677E-06	103.19
11.09	ST156	5.14505E-06	117.398
11.14	ST157	7.46569E-06	76.518
11.2	ST158	7.27616E-06	79.128
11.26	ST159	6.78114E-06	77.547
11.32	ST160	7.07834E-06	75.285

11.38	ST161	6.89781E-06	77.862
11.44	ST162	6.12822E-06	73.574
11.5	ST163	6.90624E-06	75.942
11.56	ST164	6.97805E-06	74.878
11.62	ST165	6.87322E-06	82.012
11.68	ST166	7.01549E-06	86.408
11.74	ST167	7.05331E-06	80.169
11.8	ST168	7.30004E-06	78.327
11.86	ST169	6.95972E-06	77.523
11.93	ST170	7.0984E-06	100.508
11.99	ST171	9.78964E-06	111.107
12.05	ST172	7.40183E-06	99.022
12.11	ST173	7.23596E-06	79.952
12.17	ST174	7.18182E-06	77.786
12.23	ST175	7.07744E-06	78.835
12.29	ST176	7.17207E-06	80.258
12.35	ST177	7.14103E-06	83.012
12.41	ST178	7.57382E-06	84.048
12.47	ST179	7.85471E-06	84.834
12.53	ST180	7.69114E-06	79.104
12.59	ST181	7.25102E-06	79.565
12.65	ST182	7.57999E-06	80.9
12.71	ST183	7.7201E-06	83.913
12.77	ST184	8.33228E-06	83.611
12.83	ST185	7.33936E-06	80.676
12.91	ST186	7.44357E-06	102.363
12.97	ST187	9.56652E-06	117.983
13.03	ST188	5.0797E-06	107.729
13.11	ST1	7.93595E-06	86.807
13.21	ST2	8.18208E-06	91.896
13.3	ST3	7.74231E-06	86.796
13.39	ST4	7.89123E-06	106.569
13.43	ST5	7.6837E-06	108.867
13.5	ST6	8.4713E-06	78.804
13.55	ST7	8.70157E-06	81.74
13.61	ST8	7.66247E-06	70.821
13.66	ST9	8.37142E-06	107.116
13.7	ST10	8.71512E-06	105.015
13.74	ST11	8.55031E-06	106.704
13.78	ST12	8.00334E-06	69.866
13.82	ST13	8.50249E-06	81.675
13.87	ST14	8.50998E-06	80.325
13.91	ST15	8.16175E-06	75.16
13.96	ST16	8.87086E-06	79.528
14	ST17	8.67142E-06	73.414
14.05	ST18	8.72787E-06	81.323
14.1	ST19	8.62469E-06	78.148
14.15	ST20	9.49319E-06	80.262
14.2	ST21	9.2451E-06	80.422
14.25	ST22	9.3249E-06	75.93
14.3	ST23	9.26533E-06	76.294
14.35	ST24	8.85747E-06	76.256
14.4	ST25	8.18453E-06	79.358
14.45	ST26	9.06685E-06	76.077
14.5	ST27	1.00343E-05	81.543
14.55	ST28	9.99865E-06	80.485
14.6	ST29	9.89189E-06	89.172
14.65	ST30	9.66032E-06	93.129
14.7	ST31	9.18224E-06	80.628
14.75	ST32	8.43888E-06	76.773
14.8	ST33	8.16577E-06	77.667
14.85	ST34	9.66771E-06	84.902
14.9	ST35	9.8878E-06	91.912

14.94	ST36	9.753E-06	95.607
14.99	ST37	9.2761E-06	79.758
15.03	ST38	1.0259E-05	91.171
15.08	ST39	8.42434E-06	79.047
15.15	ST40	8.35561E-06	115.406
15.26	ST41	1.14253E-05	133.291
15.36	ST42	1.08799E-05	118.286
15.45	ST43	8.18621E-06	79.894
15.51	ST44	9.47207E-06	84.544
15.55	ST45	1.12552E-05	123.898
15.58	ST46	1.1429E-05	108.122
15.63	ST47	1.16688E-05	87.406
15.7	ST48	9.66985E-06	77.31
15.77	ST49	9.91593E-06	83.204
15.84	ST50	9.97166E-06	81.649
15.91	ST51	1.05895E-05	80.943
15.98	ST52	1.21341E-05	85.481
16.05	ST53	1.17715E-05	80.455
16.12	ST54	1.20708E-05	78.955
16.19	ST55	9.92636E-06	79.432
16.26	ST56	1.04424E-05	78.515
16.35	ST57	1.19055E-05	101.533
16.47	ST58	1.15113E-05	108.355
16.59	ST59	1.30147E-05	115.579
16.69	ST60	9.05865E-06	83.944
16.77	ST61	8.86627E-06	85.592
16.85	ST62	1.09825E-05	99.824
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16.99	ST64	1.09077E-05	119.076
17.06	ST189	1.07877E-05	88.14
17.12	ST190	9.46597E-06	85.508
17.18	ST191	8.97564E-06	91.347
17.23	ST192	1.18215E-05	128.457
17.28	ST193	1.19446E-05	122.547
17.33	ST194	1.09268E-05	115.89
17.41	ST195	1.23776E-05	107.021
17.48	ST196	1.00012E-05	91.934
17.55	ST197	8.18969E-06	83.05
17.62	ST198	1.22044E-05	92.845
17.68	ST199	1.27715E-05	116.819
17.74	ST200	1.27046E-05	115.668
17.79	ST201	7.93999E-06	83.428
17.84	ST202	7.99671E-06	82.552
17.89	ST203	7.90253E-06	82.98
17.95	ST204	8.24674E-06	86.51
18	ST205	8.04087E-06	87.778
18.05	ST206	8.44073E-06	91.075
18.11	ST207	7.58551E-06	85.86
18.16	ST208	7.91025E-06	80.533
18.21	ST209	7.85355E-06	75.655
18.28	ST65	1.1087E-05	105.531
18.33	ST66	1.13005E-05	110.721
18.38	ST67	1.07874E-05	114.462
18.43	ST68	9.89579E-06	87.511
18.48	ST69	7.6928E-06	84.417
18.53	ST70	1.09187E-05	120.9
18.6	ST71	1.1201E-05	128.075
18.67	ST72	1.19598E-05	136.735
18.74	ST73	1.12305E-05	130.755
18.79	ST74	1.09638E-05	113.094
18.84	ST75	8.06623E-06	84.837
18.88	ST76	6.26965E-06	82.936
18.94	ST77	1.11663E-05	114.485

19	ST78	1.14269E-05	120.731
19.06	ST79	1.25556E-05	104.451
19.13	ST80	9.53234E-06	96.407
19.17	ST81	7.39764E-06	77.815
19.21	ST82	6.38315E-06	78.569
19.27	ST83	8.75142E-06	152.745
19.37	ST84	1.01356E-05	143.102
19.47	ST85	9.27965E-06	136.267
19.56	ST86	1.28295E-05	129.376
19.63	ST87	1.01102E-05	88.858
19.69	ST88	7.61266E-06	77.67
19.75	ST89	8.5893E-06	85.953
19.81	ST90	1.28525E-05	136.919
19.87	ST91	1.30793E-05	140.868
19.93	ST92	1.113E-05	137.7
19.99	ST93	9.73047E-06	104.51
20.04	ST94	9.13617E-06	88.701
20.09	ST95	7.70385E-06	104.078
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20.21	ST97	1.17248E-05	142.358
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20.4	ST18M3	9.00156E-06	81.912
20.46	ST18M4	1.13864E-05	71.278
20.53	ST18L2	1.22484E-05	138.899
20.59	ST18L3	1.16443E-05	129.432
20.65	ST18L4	1.05336E-05	123.85
20.72	ST19MA2	8.28635E-06	100.254
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20.84	ST19MA4	9.72744E-06	85.176
20.91	ST19LA2	1.19423E-05	79.168
20.97	ST19LA3	1.17094E-05	86.651
21.03	ST19LA4	1.13249E-05	80.423
21.1	ST19MB2	1.10742E-05	79.779
21.17	ST19MB3	1.03205E-05	77.346
21.24	ST19MB4	1.10632E-05	81.087
21.3	ST19LB2	1.15623E-05	83.508
21.36	ST19LB3	1.35367E-05	87.163
21.42	ST19LB4	1.16045E-05	92.032
21.49	ST19CM2	1.09047E-05	79.679
21.55	ST19CM3	9.17935E-06	78.186
21.61	ST19CM4	1.04711E-05	79.741
21.69	ST19LC2	1.1808E-05	112.776
21.77	ST19LC3	1.31122E-05	118.66
21.85	ST19LC4	1.04412E-05	128.651
21.91	ST20M1	8.56562E-06	109.035
21.94	ST20M2	6.88485E-06	83.838
21.97	ST20M3	8.40984E-06	96.422
22.02	ST20L2	8.95915E-06	126.716
22.07	ST20L3	9.93804E-06	134.469
22.12	ST20L4	8.24838E-06	127.525
22.18	ST21M2	1.15677E-05	94.24
22.25	ST21M3	8.66368E-06	73.626
22.32	ST21M4	9.02189E-06	82.293
22.39	ST21L2	1.19172E-05	123.862
22.44	ST21L3	1.26382E-05	131.778
22.49	ST21L4	9.96197E-06	130.698
22.57	ST22MA2	9.32953E-06	94.412
22.64	ST22MA4	8.53489E-06	78.651
22.71	ST22MA5	9.66145E-06	74.388
22.76	ST22LA2	1.22212E-05	100.578
22.79	ST22LA3	1.30771E-05	98.638
22.82	ST22LA4	1.29555E-05	96.336

22.88	ST22MB3	1.17551E-05	88.162
22.98	ST22MB5	1.0528E-05	87.358
23.08	ST22MB7	1.12813E-05	83.946
23.15	ST22LB2	1.10754E-05	111.741
23.18	ST22LB3	1.30442E-05	111.783
23.21	ST22LB4	1.16427E-05	102.544
23.26	ST22MC1	1.15868E-05	89.71
23.33	ST22MC2	1.0525E-05	88.209
23.4	ST22MC3	no data	88.811
23.45	ST22LC1	no data	117.445
23.48	ST22LC2	1.10233E-05	128.805
23.56	ST22LC3	1.36293E-05	132.062
23.63	ST22LC4	9.63581E-06	136.777
23.69	240	1.03203E-05	85.79
23.75	241	9.10531E-06	83.815
23.81	242	1.07087E-05	80.945
23.87	243	1.03059E-05	106.976
23.92	244	1.19769E-05	111.713
23.97	245	1.12663E-05	105.761
24.04	246	9.73822E-06	87.226
24.12	247	8.64768E-06	79.015
24.2	248	6.4875E-06	77.376
24.25	249	9.0188E-06	81.829
24.3	250	1.10888E-05	112.454
24.35	251	1.08155E-05	114.033
24.4	252	1.00186E-05	93.459
24.45	253	9.81145E-06	83.411
24.5	254	9.68022E-06	80.324
24.55	255	1.05962E-05	84.825
24.6	256	1.00006E-05	80.944
24.65	257	1.2269E-05	86.286
24.7	258	1.17738E-05	86.618
24.75	259	1.05164E-05	82.71
24.8	260	1.13241E-05	80.845
24.85	261	1.10792E-05	81.754
24.9	262	1.13184E-05	81.712
24.95	263	1.17266E-05	90.586
25	264	1.10982E-05	92.71
25.05	ST24MC3	no data	90.243
25.09	ST24L2	0.00001	113.907
25.15	ST24L3	1.10792E-05	119.58
25.21	ST24L4	8.50817E-06	121.363
25.28	ST268	9.66138E-06	109.906
25.36	ST269	7.2209E-06	92.909
25.44	ST270	7.21123E-06	122.941
25.5	ST271	7.29711E-06	112.022
25.53	ST272	9.57486E-06	123.841
25.56	ST273	9.20332E-06	118.406
25.63	ST274	1.0908E-05	107.153
25.75	ST275	8.00115E-06	95.81
25.87	ST276	9.087E-06	96.681
25.96	ST277	8.18191E-06	94.385
25.99	ST278	1.14392E-05	115.114
26.02	ST279	1.11452E-05	120.122
26.06	ST280	8.18408E-06	106.191
26.11	ST281	7.43684E-06	131.074
26.16	ST282	7.98852E-06	136.491
26.22	ST283	7.36964E-06	123.721
26.25	ST284	1.26534E-05	137.742
26.28	ST285	8.02415E-06	137.483
26.32	ST286	9.12466E-06	139.475
26.37	ST287	7.68197E-06	138.792
26.42	ST288	1.03082E-05	141.194

26.5	ST289	7.86406E-06	143.401
26.6	ST290	8.09692E-06	145.393
26.68	ST291	9.66814E-06	131.594
26.73	ST292	7.86432E-06	104.158
26.78	ST293	9.21539E-06	138.488
26.84	ST294	8.22598E-06	137.03
26.91	ST295	9.40489E-06	139.943
26.98	ST296	1.00384E-05	121.654
27.06	ST297	8.08786E-06	104.215
27.14	ST298	7.93829E-06	100.848
27.21	ST299	1.08363E-05	135.918
27.28	ST300	1.1977E-05	142.815
27.35	ST301	8.61761E-06	138.217
27.42	ST302	9.79555E-06	148.616
27.48	ST303	1.00304E-05	105.657
27.54	ST304	8.5068E-06	84.758
27.61	ST305	1.0782E-05	100.607
27.68	ST306	1.26806E-05	122.273
27.77	ST307	1.18391E-05	113.48
27.85	ST308	8.68172E-06	88.704
27.93	ST309	8.42959E-06	81.464
28.01	ST310	1.1565E-05	127.869
28.09	ST311	9.0031E-06	139.74
28.14	ST312	1.16767E-05	131.266
28.17	ST313	1.02706E-05	102.468
28.2	ST314	9.10602E-06	82.365
28.27	ST315	1.02091E-05	145.283
28.36	ST316	1.23915E-05	158.989
28.45	ST317	9.06889E-06	147.858
28.53	ST318	1.06683E-05	122.359
28.6	ST319	8.84106E-06	90.673
28.67	ST320	8.47331E-06	89.228
28.73	ST321	9.28094E-06	95.702
28.78	ST322	1.21715E-05	127.544
28.83	ST323	1.05003E-05	114.968
28.91	ST324	9.09551E-06	101.088
29	ST325	8.57903E-06	84.141
29.09	ST326	9.14246E-06	80.179
29.16	ST327	1.1917E-05	102.259
29.2	ST328	8.46159E-06	139.61
29.24	ST329	1.10946E-05	123.08
29.29	ST330	9.67204E-06	90.013
29.36	ST331	7.9265E-06	75.234
29.43	ST332	6.81239E-06	76.673
29.51	ST333	1.16855E-05	140.002
29.59	ST334	1.45418E-05	147.725
29.68	ST335	8.59826E-06	137.585
29.74	ST336	1.13629E-05	102.931
29.79	ST337	9.75887E-06	91.144
29.84	ST338	8.72187E-06	72.726
29.9	ST339	1.10461E-05	89.264
29.96	ST340	1.30876E-05	84.428
30.01	ST341	1.17539E-05	110.752
30.09	ST342	9.23814E-06	82.476
30.16	ST343	9.01362E-06	81.369
30.23	ST344	1.06887E-05	84.002
30.3	ST345	1.11698E-05	84.704
30.34	ST346	1.34191E-05	109.739
30.38	ST347	1.28092E-05	110.236

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	0.17	20		13	41	36	1	0	9	0.07	2.63	1.94	-28.90
ST 18L	0.35	19	0.95	5	9	83	0	0	3	0.02	2.05	0.38	-27.79
ST 18AM	0.55	19		13	44	33	1	0	9	0.09	3.09	2.86	-29.00
ST 18AL	0.75	19	1.00	9	32	57	0	0	2	0.06	1.69	2.78	-28.74
ST 18BM	0.94	20		10	35	45	1	0.5	9	0.08	2.76	3.30	-29.17
ST 18BL	1.15	19	0.95	9	25	61	0	1	4	0.05	2.00	1.63	-28.29
ST 19M	1.32	20		11	40	44	1	0	4	0.07	2.90	2.84	-29.27
ST 19L	1.53	23	1.15	3	11	84	0	0	2	0.02	1.05	0.30	-27.64
ST 20M	1.68	11		12	50	28	0	4	6	0.09	3.11	2.54	-29.14
ST 20L	1.82	15	1.36	3	13	82	0	0	2	0.02	2.44	0.26	-27.22
ST 21M	1.98	21		12	45	32	1	2	8	0.09	3.18	3.41	-29.56
ST 21L	2.15	17	0.81	4	15	79	0	0	2	0.02	2.78	0.30	-27.68
ST 21AM	2.33	22		10	37	44	0.5	2	7	0.08	3.21	4.03	-29.48
ST 21AL	2.5	8	0.36	10	29	55	0	2	4	0.04	1.90	1.00	-27.78
ST 21BM	2.7	30		9	43	48	0.5	0	0.5	0.07	2.95	2.30	-28.91
ST 21BL	2.9	10	0.33	10	30	54	0	2	4	0.04	2.07	1.02	-28.03
ST 22M	3.06	20		10	47	38	0	2	3	0.07	2.80	2.35	-29.21
ST 22L	3.25	23	1.15	3	14	81	0	0	2	0.02	1.96	0.37	-27.95
ST 22AM	3.47	19		12	48	36	0	0	4	0.08	2.96	2.58	-29.05

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

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)	Strat high (m)	Sample code	CaCO3 (%)	$\delta^{13}C_{carb}$ (‰)	$\delta^{18}O_{carb}$ (‰)
20.34	0.06	ST18M2	41.14	-0.298	-5.504
20.4	0.1	ST18M3	27.35	-0.029	-5.351
20.46	0.14	ST18M4	29.33	0.696	-5.562
20.53	0.26	ST18L2	78.76	-1.495	-5.376
20.59	0.3	ST18L3	88.97	-0.753	-5.75
20.65	0.34	ST18L4	77.84	-0.577	-5.663
20.72	0.45	ST19MA2	30.6	-0.355	-5.668
20.78	0.49	ST19MA3	24.63	-0.174	-5.453
20.84	0.53	ST19MA4	28.33	-0.105	-5.574
20.91	0.63	ST19LA2	32.26	-0.07	-5.498
20.97	0.67	ST19LA3	48.41	0.031	-5.477
21.03	0.71	ST19LA4	42.91	-0.016	-5.246
21.1	0.83	ST19MB2	34.69	-0.237	-5.673
21.17	0.87	ST19MB3	37.07	0.001	-5.535
21.24	0.91	ST19MB4	38.37	-0.057	-5.547
21.3	1.02	ST19LB2	56.42	-0.031	-5.497
21.36	1.06	ST19LB3	55.78	0.008	-5.398
21.42	1.1	ST19LB4	57.05	-0.211	-5.487
21.49	1.23	ST19CM2	43.05	-0.183	-5.492
21.55	1.28	ST19CM3	36.17	0.026	-5.594
21.61	1.33	ST19CM4	45.33	-0.034	-5.291
21.69	1.43	ST19LC2	50.09	-0.767	-5.698
21.77	1.48	ST19LC3	81.97	-1.093	-5.451
21.85	1.53	ST19LC4	78.53	-0.612	-5.664
21.91	1.61	ST20M1	35.91	-0.292	-5.555
21.94	1.64	ST20M2	26.05	-0.444	-5.416
21.97	1.67	ST20M3	40.47	-0.088	-5.407
22.02	1.75	ST20L2	81.83	-1.015	-5.649
22.07	1.78	ST20L3	81.59	-1.026	-5.658
22.12	1.81	ST20L4	77.23	-0.549	-5.649
22.18	1.93	ST21M2	33.83	-0.163	-5.578
22.25	1.98	ST21M3	27.72	-0.252	-5.474
22.32	2.03	ST21M4	43.21	-0.428	-5.649
22.39	2.11	ST21L2	77.36	-0.647	-5.53
22.44	2.14	ST21L3	81.56	-0.538	-5.723
22.49	2.17	ST21L4	79.92	-0.468	-5.643
22.57	2.28	ST22MA2	30.78	-0.111	-5.42
22.64	2.36	ST22MA4	30.2	-0.008	-5.333
22.71	2.4	ST22MA5	42.58	-0.199	-5.588
22.76	2.475	ST22LA2	51.77	-0.115	-5.613
22.79	2.49	ST22LA3	53.1	-0.027	-5.403
22.82	2.505	ST22LA4	52.34	-0.091	-5.504
22.88	2.62	ST22MB3	40.04	0.167	-5.436
22.98	2.7	ST22MB5	38.64	0.137	-5.422
23.08	2.78	ST22MB7	40.07	-0.113	-5.466
23.15	2.86	ST22LB2	58.89	-0.239	-5.541
23.18	2.88	ST22LB3	56.07	-0.178	-5.552
23.21	2.9	ST22LB4	45.23	-0.036	-5.429
23.26	2.98	ST22MC1	31.83	0.425	-5.399
23.33	3.04	ST22MC2	31.41	0.107	-5.546
23.4	3.1	ST22MC3	40.66	-0.036	-5.289
23.48	3.21	ST22LC2	83.26	-0.746	-5.843
23.56	3.25	ST22LC3	82.17	-0.951	-5.598
23.63	3.29	ST22LC4	80.43	-1.092	-5.727
23.69	3.41	ST22AM2	31.42	0.248	-5.373
23.75	3.45	ST22AM3	31.45	0.355	-5.302
23.81	3.49	ST22AM4	33.41	0.365	-5.256

Bed	Strat high (m)	SiO2	TiO2	Al2O3	CaO	Fe2O3(t)	K2O	MgO	MnO	Na2O	P2O5	LOI (1050)	Co	Cr	Cu	Ni	Sr	V	Zn
		%	%	%	%	%	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
ST 18M	0.17	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	0.35	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	0.55	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	0.75	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	0.94	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	1.15	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	1.32	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	1.53	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	1.68	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	1.82	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	1.98	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	2.15	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	2.33	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	2.5	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	2.7	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	2.9	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	3.06	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	3.25	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	3.47	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

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

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	0.17	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	0.35	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	0.55	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	0.75	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	0.94	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	1.15	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	1.32	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	1.53	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	1.68	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	1.82	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	1.98	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	2.15	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	2.33	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	2.5	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	2.7	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	2.9	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	3.06	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	3.25	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	3.47	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