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Silicate weathering in the semi-arid Southern Pyrenees during the PETM: lithium isotope evidence

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Table S1. *Clay mineralogy in the Rin section, with values in wt%.*

Interval	**Sample**	**Depth (m)**	**I/S (%)**	**Ill (%)**	**Kaol (%)**	**Chl (%)**
Pre	Rin 29	5.8	35	38	21	6
Pre	Rin 30	7.5	60	24	13	3
Pre	Rin 31	9.4	57	27	9	7
Onset	Rin 32	10.7	49	31	16	4
Onset	Rin 33	11.4	60	21	17	2
Syn	Rin 34	12.8	48	29	17	5
Syn	Rin 35	15.4	64	8	19	9
Syn	Rin 36	18.2	33	27	39	1
Syn	Rin 37	19.2	54	22	19	5
Syn	Rin 38	20.3	36	30	12	22
Syn	Rin 39	23.8	45	32	19	3
Syn	Rin 40	25.8	40	28	23	9
Syn	Rin 41	27.4	56	27	15	3
Syn	Rin 42	28.5	46	28	21	6
Syn	Rin 43	28	41	41	15	3
Syn	Rin 44	29	34	35	25	6
Syn	Rin 45	32	43	29	23	5
Syn	Rin 46	31.4	28	36	31	5
Syn	Rin 47	36.8	37	30	31	1
Syn	Rin 48	37.3	43	20	32	6
Syn	Rin 49	38.7	27	17	50	6
Syn	Rin 50	38.9				
Post	Rin 51	39.5	49	26	22	3

I/S, mixed layer illite/smectite

Table S2. *Rin geochemical data.*

Interval	Sample	Depth (m)	TOC (%)	δ^{13}C OM (‰ VPDB)	δ^7Li_{clays} (‰)	2σ (‰)	$\delta^7Li_{nodules}$ (‰)	2σ (‰)
Pre	Rin 29	5.8	0.23	-23.9	-3.3	0.4	8.6	0.2
Pre	Rin 30	7.5	0.44	-23.6	-3.7	0.3		
Pre	Rin 31	9.4	0.39	-23.0				
Onset	Rin 32	10.7	0.22	-24.6	-3.6	0.3		
Onset	Rin 33	11.4	0.15	-24.7				
Syn	Rin 34	12.8	0.18	-26.2	-3.3	0.2	-3.0	0.2
Syn	Rin 35	15.4	0.14	-25.5	-3.3	0.3	-0.2	0.1
Syn	Rin 36	18.2	0.14	-25.9	-3.2	0.4	-1.0	0.1
Syn	Rin 37	19.2	0.25	-26.5				
Syn	Rin 38	20.3	0.15	-26.3	-2.2	0.2	6.1	0.6
Syn	Rin 39	23.8	0.48	-27.6	-2.9	0.1		
Syn	Rin 40	25.8	0.18	-25.7	-2.8	0.4		
Syn	Rin 41	27.4	0.20	-26.5			0.3	0.3
Syn	Rin 42	28.5	0.16	-26.6	-2.6	0.3		
Syn	Rin 43	28.0	0.18	-26.3	-2.6	0.0		
Syn	Rin 44	29.0	0.24	-26.6	-2.7	0.3		
Syn	Rin 45	32.0	0.13	-26.1			-1.7	0.2
Syn	Rin 46	31.4	0.11	-25.9	-2.7	0.3		
Syn	Rin 47	36.8	0.08	-26.2				
Syn	Rin 48	37.3	0.08	-26.2	-2.4	0.5	-2.5	0.1
Syn	Rin 49	38.7	0.09	-26.4				
Syn	Rin 50	38.9	0.11	-26.5				
Post	Rin 51	39.5	0.23	-23.7	-2.9	0.6	1.1	0.8

OM, organic matter
TOC, total organic carbon
VPDB, Vienna Pee Dee Belemnite

Table S3. *Esplugafreda Lithium isotopes and standard deviation (0.5-2 µm).*

Interval	Depth (m)	Sample ID	δ^7Li_{clays} (‰)	2σ (‰)
Pre	0	ESP-1-2	-3.95	0.53
Pre	4	ESP-2-2		
Pre	8	ESP-3-2	-3.91	0.16
Pre	10	ESP-4-2		
POE	14	ESP-5-2	-3.32	0.64
POE	15	ESP-6-2		
POE	16	ESP-7-2		
POE	17	ESP-8-2		
POE	18	ESP-9-2	-2.97	0.62
Pre	21	ESP-10-2		
Pre	24	ESP-11-2		
Pre	28	ESP-12-2	-3.64	0.35
Syn	36	ESP-13-2	-3.09	0.32
Syn	38	ESP-14-2		
Syn	39	ESP-15-2	-2.86	0.72
Syn	44	ESP-16-2	-2.82	0.38
Syn	47	ESP-17-2	-3.30	0.19
Post	54	ESP-18-2		
Post	55	ESP-19-2	-4.83	0.56
Post	56	ESP-20-2		
Post	58	ESP-21-2	-4.67	0.64
Post	59	ESP-22-2		
Post	61	ESP-23-2	-4.47	0.25
Post	63	ESP-24-2		
Post	65	ESP-25-2	-4.68	0.23
Post	67	ESP-26-2		
Post	70	ESP-27-2	-3.85	0.29
Post	73	ESP-28-2		

Table S4. *Esplugafreda Neodymium and Samarium concentrations and isotopes (<0.5 µm).*

Sample ID	Interval	Depth (m)	$^{143}Nd/^{144}Nd$	2 σ	$\varepsilon_{Nd}(0)$*	2σ	Sm (ppm)	Nd ppm)	$^{147}Sm/^{144}Nd$**	2σ ext	$\varepsilon_{Nd}(t)$***	2σ
fraction <0.5µm												
ESP-1-0.5	Pre	0	0.512034	0.000005	-11.63	0.10	1.36	9.37	0.088	0.012	-10.86	0.18
ESP-3-0.5	Pre	8	0.512033	0.000005	-11.65	0.10	2.10	14.20	0.089	0.012	-10.89	0.18
ESP-7-0.5	POE	16	0.512023	0.000006	-11.84	0.12	3.78	25.10	0.091	0.012	-11.10	0.20
ESP-9-0.5	POE	18	0.512040	0.000009	-11.51	0.18	2.58	16.81	0.093	0.012	-10.78	0.26
ESP-13-0.5	Syn	36	0.512039	0.000006	-11.53	0.12	3.72	25.3	0.089	0.012	-10.77	0.20
ESP-17-0.5	Syn	47	0.512032	0.000004	-11.67	0.08	2.98	19.8	0.091	0.012	-10.92	0.16
ESP-26-0.5	Pos	67	0.51204	0.000007	-11.58	0.13	1.47	10.1	0.088	0.012	-10.81	0.22
ESP-27-0.5	Pos	70	0.51203	0.000007	-11.70	0.14	1.62	11.1	0.088	0.012	-10.94	0.22
fraction 0.5-2µm												
ESP-1-2	Pre	0	0.512025	0.000005	-11.80	0.10	4.22	31.5	0.081	0.012	-10.98	0.18
ESP-2-2	Pre	4	0.512040	0.000008	-11.51	0.16	3.12	23	0.082	0.012	-10.70	0.24
ESP-3-2	Pre	8	0.512027	0.000006	-11.76	0.12	2.13	15.4	0.084	0.012	-10.96	0.20
ESP-7-2	POE	16	0.51203	0.000005	-11.70	0.10	2.24	15.1	0.090	0.012	-10.95	0.18
ESP-9-2	POE	18	0.512028	0.000008	-11.74	0.16	2.39	15.71	0.092	0.012	-11.00	0.24
ESP-12-2	Pre	28	0.512039	0.000008	-11.53	0.16	2.89	20.75	0.084	0.012	-10.73	0.24
ESP-13-2	Syn	36	0.512025	0.000005	-11.80	0.10	3.35	22.7	0.089	0.012	-11.04	0.18
ESP-17-2	Syn	47	0.512027	0.000011	-11.76	0.21	2.34	19.3	0.073	0.012	-10.89	0.30
ESP-23-2	Pos	61	0.512036	0.000005	-11.59	0.10	2.9	19	0.092	0.012	-10.85	0.18
ESP-27-2	Pos	70	0.51201	0.000006	-12.09	0.12	2.05	15.9	0.078	0.012	-11.26	0.20

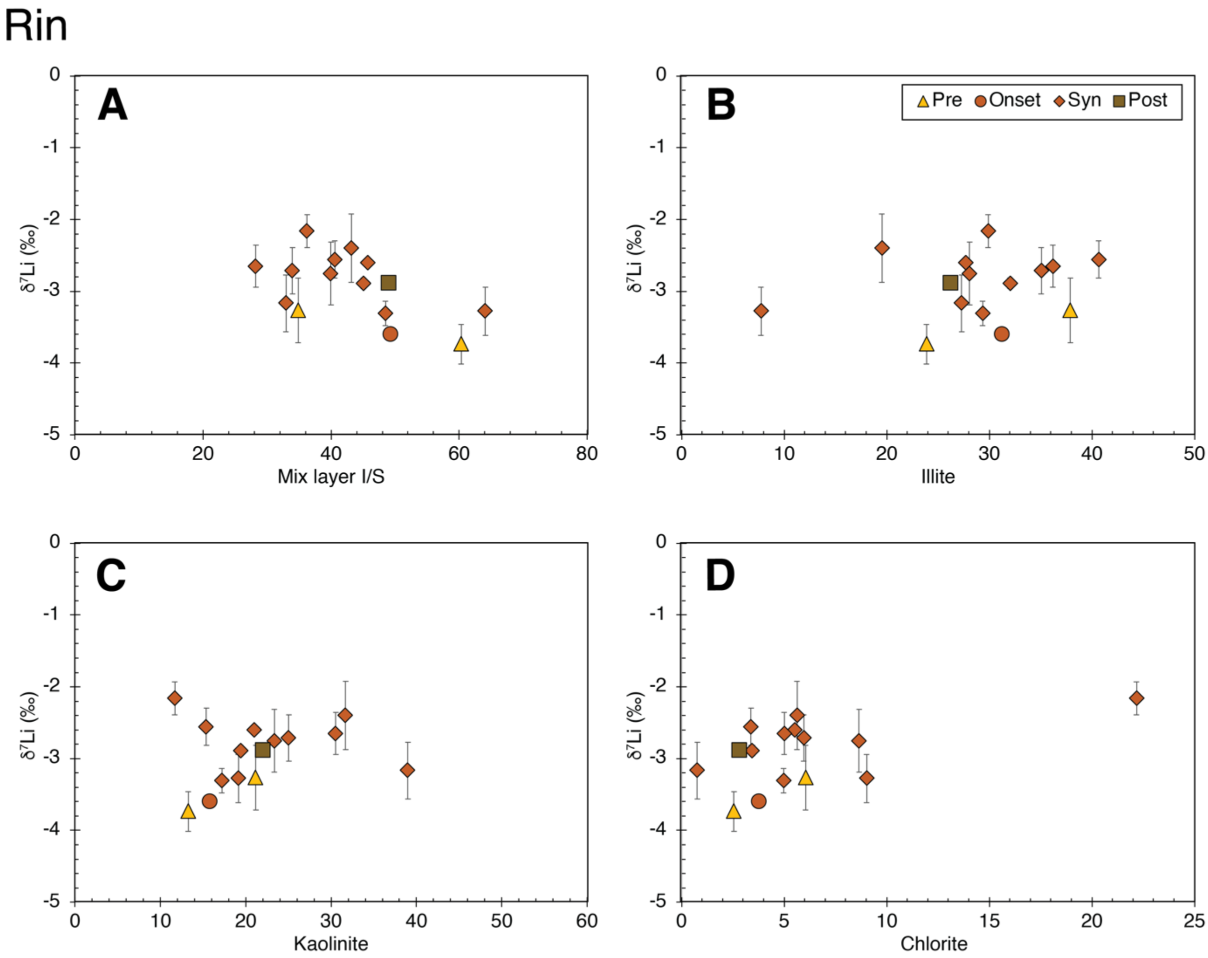

Figure S1. *Cross plots of lithium isotope composition (δ^7Li) in clays versus clay mineral abundances in the Rin section. (A) Mixed-layer illite–smectite (I/S), (B) illite, (C) kaolinite, and (D) chlorite. Clay mineral abundances are reported in wt%. No systematic correlation is observed between δ^7Li and the relative abundance of individual clay minerals within analytical uncertainty.*

Esplugafreda

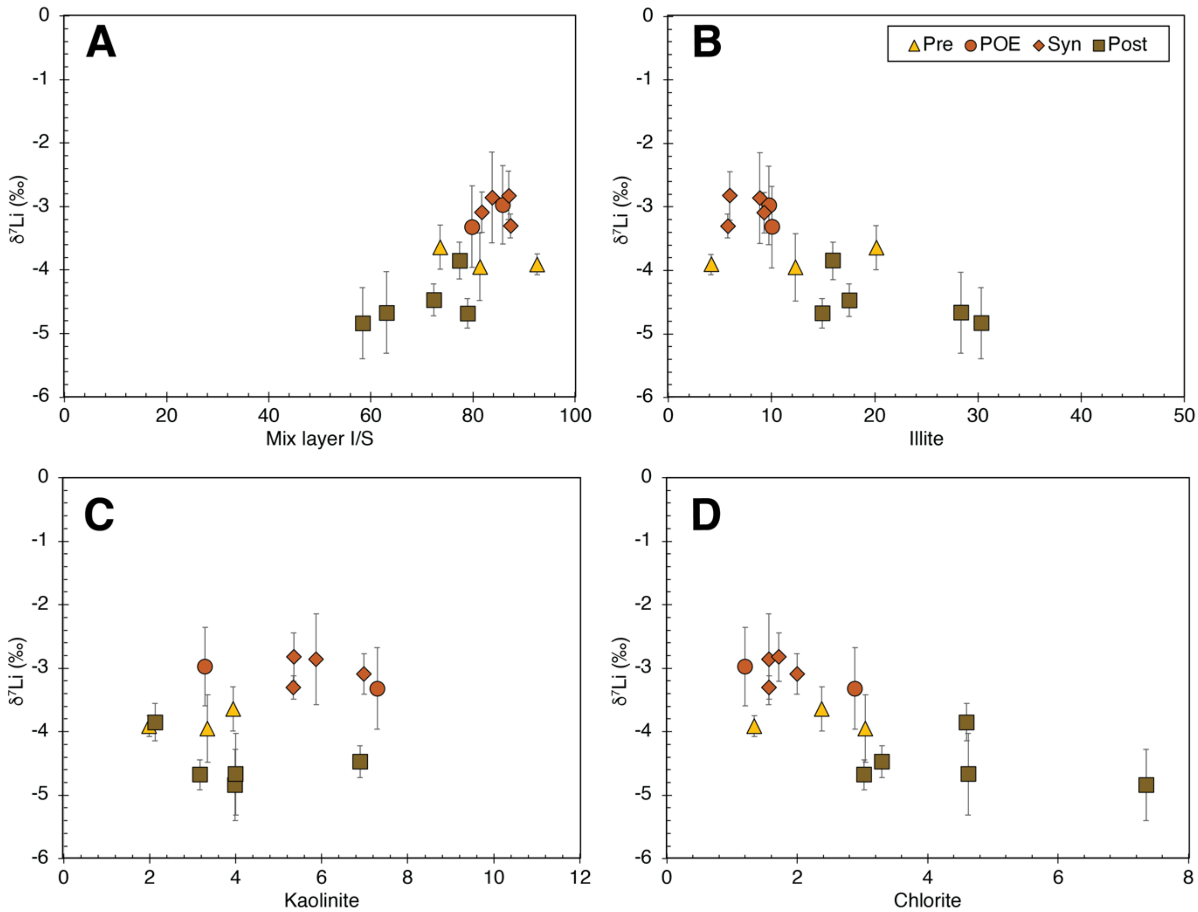

Figure S2. *Cross plots of lithium isotope composition (δ^{7}Li) in clays versus clay mineral abundances in the Esplugafreda section. (A) Mixed-layer illite–smectite (I/S), (B) illite, (C) kaolinite, and (D) chlorite. Clay mineral abundances are reported in wt%. Samples from the pre-PETM, Pre-Onset Excursion (POE), and syn-PETM intervals cluster at high mixed-layer I/S abundances (~80 wt%) and display relatively heavier δ^{7}Li$_{clays}$ values. In contrast, recovery-phase samples form a distinct cluster characterised by lighter δ^{7}Li$_{clays}$, coincident with increased abundances of illite, kaolinite, and chlorite.*