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Supplementary material: Insights on the Permian tuff beds from the Saint-Affrique Basin (Massif Central, France): an integrated geochemical and geochronological study

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Supplementary Table S1. Whole-rock geochemistry data from the Saint-Affrique Basin tuffs

Samples		DEV21-1	PER21-3	PER21-4	CAN21-5	GAL21-6	GAL21-7	CAM20-3	LAT20-1
SiO_2	wt%	74.04	70.80	77.85	72.51	75.48	73.07	75.73	42.99
Al_2O_3	wt%	14.45	15.60	12.43	14.61	11.96	10.73	10.19	11.28
Fe_2O_3	wt%	0.74	2.70	0.91	0.28	1.80	2.22	1.86	5.05
MnO	wt%	<L.D.	<L.D.	0.015	<L.D.	0.027	0.070	0.072	0.17
MgO	wt%	0.28	0.53	0.21	0.14	3.17	2.77	1.09	6.05
CaO	wt%	0.08	0.04	0.10	<L.D.	0.28	2.61	2.38	10.33
Na_2O	wt%	1.87	0.23	3.09	0.08	0.74	1.76	3.63	4.07
K_2O	wt%	6.48	5.61	3.85	10.20	0.62	0.77	0.59	1.47
TiO_2	wt%	0.042	0.24	0.032	0.13	0.13	0.20	0.19	0.48
P_2O_5	wt%	<L.D.	<L.D.	<L.D.	<L.D.	<L.D.	<L.D.	<L.D.	0.22
LOI	wt%	2.50	4.69	2.04	1.73	5.89	5.66	3.66	17.15
As	ppm	4.86	2.81	2.84	1.25	5.20	5.07	1.76	4.67
Ba	ppm	150	223	92.0	134	352	2273	116	180
Be	ppm	4.01	3.30	2.62	0.87	1.73	1.60	1.17	1.37
Bi	ppm	0.35	0.18	0.95	0.70	0.18	0.24	0.37	0.29
Cd	ppm	<L.D.	<L.D.	<L.D.	<L.D.	<L.D.	0.14	0.12	0.12
Co	ppm	0.68	3.33	0.97	0.72	7.01	9.20	3.43	16.0
Cr	ppm	12.3	29.9	28.4	20.4	20.0	37.7	13.6	58.3
Cs	ppm	4.82	10.2	2.20	1.07	2.79	2.52	2.05	2.41
Cu	ppm	7.5	8.2	5.4	3.8	77.5	78.5	70.8	13.0
Ga	ppm	16.1	23.9	13.4	16.5	17.2	18.1	9.68	10.2
Ge	ppm	1.22	1.71	1.29	1.00	1.81	1.77	1.59	1.28
Hf	ppm	1.51	4.17	1.50	1.54	4.00	5.45	5.84	2.77
In	ppm	0.03	0.05	0.03	<L.D.	0.08	0.06	0.05	0.09
Mo	ppm	0.50	<L.D.	1.64	0.99	0.68	1.63	<L.D.	<L.D.
Nb	ppm	4.98	23.7	7.37	8.28	13.3	11.4	9.79	8.91
Ni	ppm	2.9	7.7	3.3	<L.D.	4.7	7.7	5.9	19.2
Pb	ppm	4.14	5.72	59.5	24.9	2.80	4.22	7.90	12.4
Rb	ppm	250	260	132	161	28.2	34.1	26.4	47.1
Sb	ppm	0.79	2.07	2.52	1.39	0.49	0.52	0.80	10.4
Sc	ppm	1.57	5.05	1.06	2.44	12.73	7.53	9.65	27.58
Sn	ppm	5.88	7.02	6.05	4.63	6.31	4.52	5.36	2.65
Sr	ppm	17.9	43.5	22.1	27.9	28.9	85.4	64.3	328
Ta	ppm	1.38	1.78	1.35	1.55	1.39	1.17	1.16	0.84
Th	ppm	6.09	11.9	6.24	7.88	15.3	12.9	13.2	17.2
U	ppm	2.04	3.31	2.33	2.30	3.72	3.85	3.23	2.16
V	ppm	6.4	25.3	4.2	12.2	10.9	20.0	14.7	78.3
W	ppm	0.86	4.20	1.63	1.48	0.95	1.84	0.82	1.70
Y	ppm	3.90	5.72	2.93	7.41	33.8	30.9	30.8	32.2

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Supplementary Table S1. (continued)

Samples		DEV21-1	PER21-3	PER21-4	CAN21-5	GAL21-6	GAL21-7	CAM20-3	LAT20-1
Zn	ppm	14.9	38.4	23.8	<L.D.	177	159	62.5	42.7
Zr	ppm	29.8	111	33.0	38.2	93.3	179	186	165
La	ppm	5.33	24.8	12.8	27.1	22.8	28.2	23.8	26.6
Ce	ppm	8.95	45.6	25.2	34.4	56.0	62.2	56.6	54.8
Pr	ppm	0.986	4.64	2.98	5.61	7.47	7.78	7.25	6.65
Nd	ppm	3.60	14.8	11.1	20.2	30.6	30.5	29.5	26.5
Sm	ppm	0.845	2.31	2.05	3.91	7.87	6.71	7.23	6.38
Eu	ppm	0.249	0.400	0.371	0.745	0.405	0.856	0.545	1.38
Gd	ppm	0.710	1.52	1.26	2.66	6.63	5.86	6.11	5.95
Tb	ppm	0.125	0.218	0.148	0.324	1.13	0.948	0.957	0.969
Dy	ppm	0.723	1.21	0.633	1.52	7.28	5.85	5.75	5.96
Ho	ppm	0.143	0.225	0.103	0.265	1.50	1.24	1.16	1.19
Er	ppm	0.365	0.604	0.238	0.645	4.14	3.35	3.22	3.20
Tm	ppm	0.0535	0.0948	0.0321	0.0897	0.648	0.517	0.499	0.483
Yb	ppm	0.343	0.657	0.198	0.556	4.28	3.41	3.19	3.10
Lu	ppm	0.047	0.099	0.028	0.080	0.623	0.509	0.470	0.468
Eu/Eu*		0.98	0.65	0.70	0.70	0.17	0.42	0.25	0.69
∑REE		22.47	97.15	57.17	98.04	151.38	157.88	146.25	143.56

Supplementary Table S2. Operating conditions for the LA–ICP–MS equipment for the zircon U–Pb LA–ICP–MS dating

Laboratory and sample preparation	
Laboratory name	GeOHeLiS Analytical Platform, OSUR, Univ Rennes 1, France
Sample type/mineral	Zircon
Sample preparation	Crushed sample, grains mounted in epoxy puck
Imaging	CL: RELION CL instrument, Olympus Microscope BX51WI, Leica Color Camera DFC 420C
Laser ablation system	
Make, Model and type	ESI NWR193UC, Excimer
Ablation cell	ESI NWR TwoVol2
Laser wavelength	193 nm
Pulse width	<5 ns
Fluence	7.4 J/cm^2
Repetition rate	3 Hz
Spot size	30 µm
Sampling mode/pattern	Single spot

(continued on next page)

Supplementary Table S2. (continued)

Laboratory and sample preparation	
Carrier gas	100% He, Ar make-up gas and N2 (3 ml/mn) combined using in-house smoothing device
Background collection	20 s
Ablation duration	60 s
Wash-out delay	15 s
Carrier gas flow (He)	0.76 l/min
ICP-MS Instrument	
Make, Model and type	Agilent 7700×, Q-ICP-MS
Sample introduction	Via conventional tubing
RF power	1350 W
Sampler, skimmer cones	Ni
Extraction lenses	X type
Make-up gas flow (Ar)	0.75 l/min
Detection system	Single collector secondary electron multiplier
Data acquisition protocol	Time-resolved analysis
Scanning mode	Peak hopping, one point per peak
Detector mode	Pulse counting, dead time correction applied, and analog mode when signal intensity > ~ 10^6 cps
Masses measured	^{204}(Hg + Pb), ^{206}Pb, ^{207}Pb, ^{208}Pb, ^{232}Th, ^{238}U
Integration time per peak	10–30 ms (^{207}Pb)
Sensitivity/Efficiency	23,000 cps/ppm Pb (50 μm, 10 Hz)
Data Processing	
Gas blank	20 s on-peak
Calibration strategy	GJ1 zircon standard used as primary reference material, Plešovice used as secondary reference material (quality control)
Common-Pb correction, composition and uncertainty	No common-Pb correction
Reference Material info	GJ1 [Jackson et al., 2004], Plešovice [Sláma et al., 2008]
Data processing package	Iolite [Paton et al., 2010]
Uncertainty level and propagation	Ages are quoted at 2 sigma absolute, propagation is by quadratic addition according to Horstwood et al. [2016]. Reproducibility and age uncertainty of reference material are propagated.
Quality control/validation	Plešovice: concordia age = 332 ± 4 Ma (N = 7; MSWD = 2.1)

Supplementary Table S3. LA–ICP–MS U–Pb data and LA–MC–ICP–MS Lu–Hf data for zircon extracted from tuff samples from the Saint-Affrique Basin. f206$_c$% = (^{207}Pb/^{206}Pb$_m$ − ^{207}Pb/^{206}Pb*)/(^{207}Pb/^{206}Pb$_C$ − ^{207}Pb/^{206}Pb*) × 100. ^{207}Pb/^{206}Pb$_m$ is the measured ratio; ^{207}Pb/^{206}Pb* is the radiogenic ratio calculated for the age of the grain; ^{207}Pb/^{206}Pb$_C$ is the common Pb ratio calculated at the age of the grain following the Pb evolution model of Stacey and Kramers [1975]

							Data for Wetherill plot					Apparent Ages							Measured				Age Corrected		
Identifier	Grain	f206c	206Pb	Uppm	Th/U	Pbppm	207Pb/235U	2se%	206Pb/238U	2se%	Rho	207Pb/206Pb	2se (abs)	206Pb/238U	2se (abs)	207Pb/235U	2se (abs)	% conc	176Yb/177Hf	176Lu/177Hf	176Hf/177Hf	± 2s	176Hf/177Hfi	eHfi CHUR	TDM (Ma)
Lat20-1																									
S-240621a-01.d	Zr1-1	1.559	17767	236	0.18	91	0.3734	5.5	0.04422	4.4	0.80	753	88	279	12	322	15	86.6							
S-240621a-02.d	Zr2-1	0.115	33516	390	0.16	106	0.3638	4.4	0.05089	4.0	0.91	359	55	320	13	315	12	101.6							
S-240621a-03.d	Zr2-2	0.000	30955	360	0.15	86	0.3606	4.4	0.05100	4.0	0.90	308	56	321	13	313	12	102.6							
S-240621a-04.d	Zr3-1	0.000	29708	347	0.16	86	0.3550	4.6	0.05159	4.0	0.88	217	60	324	13	308	12	105.1							
S-240621a-05.d	Zr3-2	0.023	24714	329	0.18	85	0.3185	4.5	0.04482	4.1	0.91	291	63	283	11	281	11	100.7	0.029	0.0010	0.28261	0.00003	0.28260	-0.3	1298
S-240621a-06.d	Zr4-1	0.135	34879	507	0.21	122	0.3166	4.5	0.04368	4.1	0.90	323	58	276	11	279	11	98.7	0.014	0.0005	0.28262	0.00003	0.28262	0.2	1263
S-240621a-07.d	Zr4-2	0.094	28379	400	0.18	86	0.3191	4.4	0.04393	4.0	0.90	310	53	277	11	281	11	98.6							
S-240621a-08.d	Zr5-1	0.114	23589	325	0.16	67	0.3237	4.4	0.04445	4.0	0.91	320	54	280	11	285	11	98.5	0.024	0.0009	0.28262	0.00003	0.28262	0.3	1259
S-240621a-09.d	Zr6-1	0.009	30013	410	0.19	104	0.3144	4.3	0.04462	4.0	0.92	285	51	281	11	278	11	101.4	0.027	0.0010	0.28261	0.00003	0.28260	-0.1	1287
S-240621a-10.d	Zr6-2	0.017	32525	439	0.20	116	0.3174	4.3	0.04475	3.9	0.92	288	49	282	11	280	10	100.8							
S-240621a-11.d	Zr7-1	0.023	32453	436	0.20	124	0.3190	4.3	0.04480	4.0	0.91	291	53	282	11	281	11	100.5	0.024	0.0008	0.28262	0.00004	0.28262	0.3	1256
S-240621a-12.d	Zr8-1	0.148	39130	548	0.20	146	0.3160	4.4	0.04367	4.0	0.91	327	58	276	11	279	11	98.8	0.031	0.0011	0.28261	0.00003	0.28260	-0.2	1289
S-240621a-13.d	Zr8-2	0.125	24640	331	0.16	75	0.3201	4.5	0.04372	4.0	0.89	320	59	276	11	282	11	97.8							
S-240621a-14.d	Zr9-1	0.000	27274	363	0.18	88	0.3185	4.3	0.04415	4.0	0.92	278	52	279	11	281	11	99.2							
S-240621a-15.d	Zr10-1	0.000	46823	612	0.17	134	0.3134	4.7	0.04378	4.2	0.90	248	66	276	11	277	11	99.8	0.021	0.0008	0.28263	0.00002	0.28263	0.8	1229
S-240621a-16.d	Zr10-2	0.092	20745	276	0.14	50	0.3210	4.5	0.04417	4.0	0.89	311	60	279	11	283	11	98.6							
S-240621a-17.d	Zr11-1	0.248	42700	574	0.18	121	0.3243	4.3	0.04456	4.0	0.92	366	53	281	11	285	11	98.5							
S-240621a-18.d	Zr11-2	1.216	40364	595	0.26	174	0.3668	4.7	0.04456	4.1	0.87	662	65	281	11	317	13	88.6							
S-240621a-19.d	Zr12-1	6.382	185104	9651	0.10	908	0.1656	4.3	0.01269	4.2	0.98	1591	37	81	3	156	6	52.2							
S-240621a-20.d	Zr13-1	0.095	24468	331	0.16	73	0.3230	4.7	0.04551	4.1	0.87	320	67	287	11	284	12	101.0	0.028	0.0010	0.28261	0.00003	0.28261	-0.1	1283
S-240621a-21.d	Zr13-2	0.050	36555	525	0.19	140	0.3144	4.3	0.04469	3.9	0.91	299	53	282	11	278	10	101.5							
S-240621a-22.d	Zr14-1	0.156	62501	951	0.20	254	0.3203	4.5	0.04524	4.1	0.91	339	58	285	11	282	11	101.1	0.039	0.0014	0.28262	0.00003	0.28262	0.3	1257
S-240621a-23.d	Zr15-1	0.175	39275	575	0.19	152	0.3204	4.4	0.04450	4.0	0.90	341	57	281	11	282	11	99.5							
S-240621a-24.d	Zr16-1	0.306	62776	951	0.19	241	0.3209	4.6	0.04396	4.2	0.92	382	62	277	11	283	11	98.2	0.027	0.0009	0.28262	0.00003	0.28261	0.2	1266
																		Moyenne	***0.026***	***0.0009***	***0.28262***		***0.28261***	***0.1***	***1269***
																		±2se	***0.004***	***0.0001***	***0.00001***		***0.00001***	***0.2***	***13***
Cam20-3																									
S-240621a-25.d	Zr1	0.424	83093	721	0.18	207	0.5479	4.2	0.06733	4.0	0.95	553	41	420	16	444	15	94.7							
S-240621a-26.d	Zr2	0.106	80525	1096	0.17	168	0.3251	4.2	0.04465	4.0	0.95	318	45	282	11	286	11	98.5							
S-240621a-27.d	Zr3	0.222	119512	1745	0.22	334	0.3150	4.3	0.04301	4.2	0.98	348	50	271	11	278	11	97.6	0.057	0.0020	0.28248	0.00003	0.28247	-4.8	1580
S-240621a-28.d	Zr4	0.493	64303	982	0.20	186	0.3233	4.8	0.04265	4.5	0.92	436	63	269	12	284	12	94.7							
S-240621a-29.d	Zr5	0.082	121360	1757	0.16	275	0.3153	4.2	0.04389	4.0	0.96	306	43	277	11	278	10	99.5							
S-240621a-30.d	Zr6	0.135	49238	666	0.19	138	0.3331	4.2	0.04574	3.9	0.94	335	44	288	11	292	11	98.8							
S-240621a-31.d	Zr7	0.278	117331	1070	0.03	57	0.5525	4.2	0.06997	4.0	0.96	524	42	436	17	447	15	97.6							
S-240621a-32.d	Zr8	0.527	98225	837	0.32	544	0.5793	4.2	0.07038	4.1	0.96	600	44	438	17	464	16	94.5							
S-240621a-33.d	Zr9	0.009	91373	1146	0.21	303	0.3255	4.2	0.04538	4.0	0.95	289	42	286	11	286	10	100.0							
S-240621a-34.d	Zr10	0.000	141351	1719	0.28	618	0.3279	4.1	0.04610	3.9	0.95	270	40	291	11	288	10	100.9	0.096	0.0033	0.28253	0.00004	0.28251	-3.4	1493
S-240621a-35.d	Zr11	0.000	60002	447	0.04	41	0.5716	4.2	0.07416	3.9	0.95	458	42	461	18	459	15	100.5							
S-240621a-36.d	Zr12	0.303	116313	1451	0.32	564	0.3365	4.1	0.04530	3.9	0.96	389	40	286	11	295	11	97.0	0.122	0.0041	0.28256	0.00003	0.28254	-2.6	1444
S-240621a-37.d	Zr13	0.110	98137	1282	0.21	335	0.3146	4.2	0.04393	4.0	0.95	316	43	277	11	278	10	99.8	0.033	0.0012	0.28253	0.00003	0.28253	-2.9	1462
S-240621a-38.d	Zr14	0.245	143134	1752	0.27	613	0.3302	4.2	0.04475	4.0	0.95	366	45	282	11	290	11	97.4	0.052	0.0019	0.28252	0.00003	0.28251	-3.6	1506
S-240621a-39.d	Zr15	1.268	122145	1551	0.45	907	0.3765	4.1	0.04438	3.9	0.95	675	39	280	11	324	12	86.3							
S-240621a-40.d	Zr16	0.177	86353	1109	0.51	694	0.3276	4.1	0.04501	3.9	0.95	345	41	284	11	288	10	98.6	0.088	0.0030	0.28256	0.00003	0.28254	-2.4	1429
S-240621a-41.d	Zr17	0.126	48517	402	0.20	158	0.5554	4.2	0.07023	3.9	0.95	478	43	438	17	449	15	97.6							
S-240621a-42.d	Zr18	0.057	122426	1717	0.23	462	0.3109	4.2	0.04310	4.0	0.96	292	44	272	11	275	10	99.0	0.034	0.0013	0.28249	0.00002	0.28248	-4.5	1560
S-240621a-43.d	Zr19	0.702	50442	718	0.47	409	0.3457	5.0	0.04379	4.6	0.91	508	71	276	12	302	13	91.6							
S-240621a-44.d	Zr20	0.256	42332	347	0.09	53	0.5839	4.3	0.07290	4.1	0.94	534	49	454	18	467	16	97.1							
S-240621a-45.d	Zr21	0.110	126185	1692	0.20	418	0.3204	4.2	0.04406	4.0	0.96	316	43	278	11	282	10	98.5	0.054	0.0020	0.28250	0.00002	0.28249	-4.3	1549
S-240621a-46.d	Zr22	0.072	101278	1304	0.32	531	0.3209	4.1	0.04436	3.9	0.95	305	40	280	11	283	10	99.0	0.058	0.0020	0.28250	0.00003	0.28249	-4.3	1549
S-240621a-47.d	Zr23	0.359	94123	1165	0.62	907	0.3369	4.4	0.04439	4.0	0.91	402	51	280	11	295	11	95.0							
S-240621a-48.d	Zr24	0.764	34674	463	0.31	192	0.3500	4.4	0.04416	4.1	0.91	528	53	279	11	305	12	91.4							
S-240621a-49.d	Zr25-1	0.063	91311	338	0.20	250	1.5489	4.1	0.15698	3.9	0.96	955	35	940	34	950	25	98.9							
S-240621a-50.d	Zr25-2	0.125	154083	551	0.06	130	1.5430	4.3	0.15532	4.1	0.95	961	40	931	35	948	26	98.2							
S-240621a-51.d	Zr26	0.934	25456	308	0.20	76	0.3690	6.8	0.04476	4.3	0.63	582	121	282	12	319	19	88.5							
S-240621a-52.d	Zr27	0.000	194105	212	0.51	1162	12.7440	4.0	0.51179	3.9	0.97	2646	26	2664	85	2661	38	100.6							
S-240621a-53.d	Zr28	0.055	125187	1541	0.21	369	0.3184	4.1	0.04390	3.9	0.96	296	40	277	11	281	10	98.7							
S-240621a-54.d	Zr29	0.615	36917	447	0.22	125	0.3499	5.5	0.04451	4.7	0.85	485	91	281	13	305	15	92.2							
S-240621a-55.d	Zr30	0.091	93103	1143	0.18	243	0.3181	4.1	0.04386	3.9	0.95	309	41	277	11	280	10	98.7							
S-240621a-56.d	Zr31	0.070	123082	1579	0.20	341	0.3107	4.2	0.04326	4.0	0.96	298	43	273	11	275	10	99.4	0.083	0.0029	0.28253	0.00004	0.28251	-3.5	1498

(continued on next page)

Supplementary Table S3. (continued)

																			Moyenne	***0.068***	***0.0024***	***0.28252***		***0.28251***	***-3.6***	***1507***
																			±2se	***0.018***	***0.0006***	***0.00002***		***0.00001***	***0.5***	***33***
Gal21-7																										
S-041121a-35.d	Zr1	0.000	38984	548	0.13	93	0.3163	7.6	0.04401	5.7	0.75	273	155	278	15	279	19	99.5		0.031	0.0011	0.28256	0.00002	0.28255	-2.1	1408
S-041121a-36.d	Zr2	0.022	34220	524	0.24	140	0.3152	7.9	0.04462	5.8	0.74	289	160	281	16	278	19	101.2								
S-041121a-37.d	Zr3	0.045	38250	558	0.25	163	0.3177	7.6	0.04382	5.7	0.75	292	154	276	15	280	19	98.7								
S-041121a-38.d	Zr4	0.107	28330	404	0.28	137	0.3182	7.7	0.04348	5.7	0.74	312	156	274	15	281	19	97.8								
S-041121a-39.d	Zr5	1.102	44125	630	0.28	253	0.3629	7.7	0.04311	5.7	0.75	622	148	272	15	314	21	86.6								
S-041121a-40.d	Zr6	0.013	18551	288	0.20	68	0.3050	8.0	0.04347	5.9	0.74	279	165	274	16	270	19	101.5								
S-041121a-41.d	Zr7	0.604	6928	108	0.29	35	0.3303	8.4	0.04284	5.9	0.71	472	169	270	16	290	21	93.3								
S-041121a-46.d	Zr12	0.190	49124	776	0.20	184	0.3194	7.9	0.04394	5.8	0.73	343	160	277	16	281	20	98.5		0.047	0.0017	0.28256	0.00003	0.28255	-2.1	1412
S-041121a-49.d	Zr15	0.000	40368	332	0.42	295	0.5839	7.6	0.07587	5.7	0.75	422	149	471	26	467	28	101.0								
S-041121a-50.d	Zr16	0.008	29379	466	0.26	135	0.3057	8.0	0.04343	5.9	0.74	277	165	274	16	271	19	101.2								
S-041121a-51.d	Zr17	0.000	62834	944	0.40	461	0.3096	7.5	0.04368	5.7	0.75	255	152	276	15	274	18	100.6		0.048	0.0017	0.28258	0.00003	0.28257	-1.4	1364
S-041121a-52.d	Zr18	0.359	61132	987	0.17	210	0.3249	7.9	0.04348	5.9	0.74	397	156	274	16	286	20	96.0								
S-041121a-53.d	Zr19	0.042	123937	1886	0.17	392	0.3129	7.5	0.04358	5.7	0.76	290	150	275	15	276	18	99.5								
S-041121a-54.d	Zr20	0.000	20601	294	0.38	151	0.3190	7.9	0.04428	5.8	0.74	279	164	279	16	281	19	99.3		0.057	0.0020	0.28260	0.00004	0.28259	-0.7	1319
S-041121a-55.d	Zr21	0.145	112112	1758	0.45	875	0.3128	7.6	0.04329	5.8	0.76	324	151	273	15	276	18	98.9		0.086	0.0030	0.28261	0.00004	0.28259	-0.5	1310
S-041121a-56.d	Zr22	0.025	10563	159	0.25	49	0.3191	8.4	0.04461	5.9	0.70	290	176	281	16	281	21	100.1								
S-041121b-02.d	Zr24	0.127	35935	598	0.30	198	0.3137	6.6	0.04348	2.8	0.43	319	84	274	8	277	16	99.0								
S-041121b-03.d	Zr25	0.599	44301	677	0.22	191	0.3339	6.2	0.04305	2.7	0.43	472	67	272	7	293	16	92.9								
S-041121b-04.d	Zr26	0.152	40783	606	0.34	252	0.3211	6.2	0.04379	2.6	0.42	329	70	276	7	283	15	97.7								
S-041121b-05.d	Zr27	0.274	32966	550	0.48	326	0.3301	6.2	0.04426	2.6	0.42	373	66	279	7	290	16	96.4		0.067	0.0024	0.28257	0.00004	0.28256	-1.9	1394
S-041121b-06.d	Zr28	0.615	17642	290	0.42	135	0.3387	6.6	0.04329	2.8	0.42	478	89	273	7	296	17	92.2								
S-041121b-07.d	Zr29	0.418	18409	296	0.45	157	0.3370	6.4	0.04403	2.6	0.41	419	80	278	7	295	16	94.2								
S-041121b-08.d	Zr30	0.000	11564	174	0.28	58	0.3250	6.4	0.04524	2.6	0.40	271	79	285	7	286	16	99.8		0.050	0.0018	0.28259	0.00005	0.28258	-1.1	1345
S-041121b-09.d	Zr31	0.073	12341	186	0.22	54	0.3292	6.3	0.04443	2.5	0.40	306	78	280	7	289	16	97.0		0.042	0.0016	0.28261	0.00004	0.28260	-0.3	1296
S-041121b-10.d	Zr32	0.069	34262	533	0.31	209	0.3371	6.1	0.04500	2.6	0.42	308	66	284	7	295	16	96.2								
S-041121b-11.d	Zr33	0.166	34889	554	0.23	157	0.3430	6.3	0.04450	2.7	0.42	338	74	281	7	299	16	93.7								
S-041121b-12.d	Zr34	0.099	66637	1043	0.16	214	0.3297	6.0	0.04372	2.6	0.42	311	60	276	7	289	15	95.3								
S-041121b-13.d	Zr35	0.323	49915	793	0.30	295	0.3437	6.2	0.04403	2.6	0.43	388	68	278	7	300	16	92.6								
S-041121b-14.d	Zr36	0.000	38757	626	0.30	227	0.3363	6.7	0.04516	3.1	0.47	270	81	285	9	294	17	96.7		0.051	0.0018	0.28260	0.00003	0.28259	-0.6	1312
S-041121b-15.d	Zr37	0.171	35126	567	0.48	307	0.3392	6.5	0.04467	3.0	0.46	341	80	282	8	297	17	95.0		0.069	0.0024	0.28259	0.00003	0.28257	-1.3	1357
S-041121b-16.d	Zr38	0.396	51279	839	0.21	218	0.3432	6.3	0.04431	3.0	0.47	414	73	280	8	300	16	93.3								
																			Moyenne	***0.055***	***0.0019***	***0.28259***		***0.28258***	***-1.2***	***1352***
																			±2se	***0.010***	***0.0003***	***0.00001***		***0.00001***	***0.4***	***27***
Can21-5																										
S-041121a-02.d	Zr2	13.383	73644	712	0.34	1020	1.5029	7.6	0.06785	5.7	0.75	2491	114	423	23	932	46	45.4								
S-041121a-03.d	Zr3	0.000	245310	312	0.24	933	14.7960	7.4	0.52169	5.6	0.76	2865	106	2706	125	2802	71	97.8								
S-041121a-04.d	Zr4	29.819	164216	1863	0.44	3135	2.3669	7.5	0.05963	6.3	0.83	3440	107	373	23	1233	54	30.3								
S-041121a-05.d	Zr5	27.869	301413	2941	0.15	5450	2.5326	7.5	0.06540	5.6	0.75	3362	103	408	22	1281	54	31.9								
S-041121a-06.d	Zr6	0.000	459264	865	0.03	319	7.7667	7.5	0.35564	5.7	0.77	2447	111	1961	97	2204	67	90.1								
S-041121a-07.d	Zr7	6.063	175113	1289	0.17	1115	1.3196	7.7	0.08819	5.6	0.73	1761	123	545	30	854	45	63.8								
S-041121a-08.d	Zr8	2.557	52299	227	0.53	543	1.7583	7.5	0.14339	5.7	0.75	1404	128	864	46	1030	49	83.8								
S-041121a-09.d	Zr9	38.654	284803	3220	0.30	7648	2.6707	7.5	0.05271	5.7	0.76	3765	99	331	18	1320	55	25.1								
S-041121a-10.d	Zr10	9.500	60189	530	0.39	725	1.3501	8.1	0.07484	5.8	0.72	2141	132	465	26	868	47	53.6								
S-041121a-11.d	Zr11	33.646	86671	1311	0.42	2241	1.8345	7.5	0.04166	5.7	0.76	3574	101	263	15	1058	49	24.9								
S-041121a-12.d	Zr12	0.000	143421	234	0.36	838	6.6329	7.4	0.37025	5.6	0.76	2081	115	2031	98	2064	66	99.2								
S-041121a-13.d	Zr13	0.000	57772	97	0.35	307	6.5968	7.5	0.37170	5.6	0.76	2073	115	2037	99	2059	66	99.3								
S-041121a-14.d	Zr14	7.575	63538	471	0.52	853	1.4093	7.6	0.08582	5.7	0.75	1950	120	531	29	893	45	59.4								

(continued on next page)

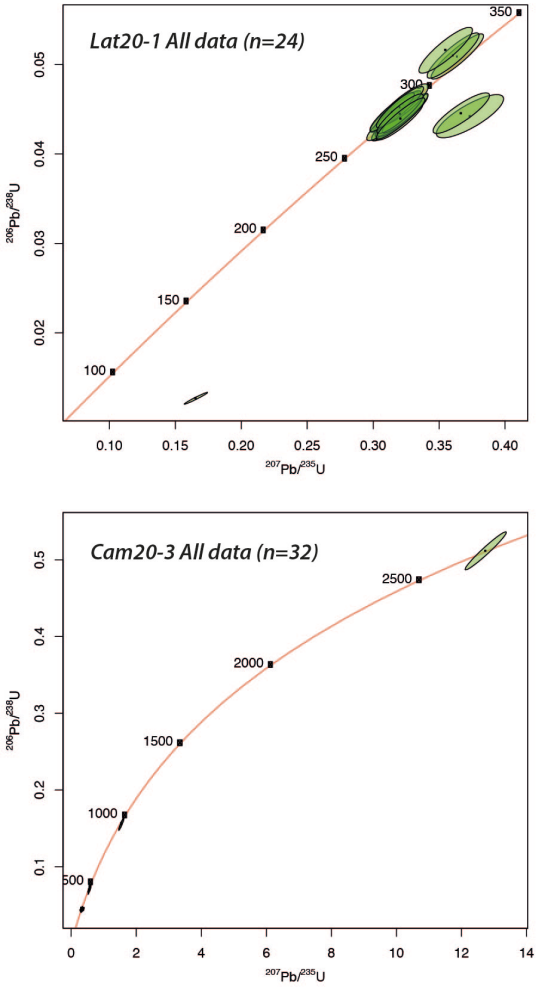
Supplementary Table S3. (continued)

Per21-4																		
S-041121a-15.d	Zr1	0.000	69955	256	0.60	694	1.7248	7.5	0.16802	5.6	0.75	1044	133	1001	52	1018	48	97.5
S-041121a-16.d	Zr2	0.506	28678	184	0.43	211	0.8411	7.6	0.09454	5.7	0.74	743	142	582	31	620	35	94.0
S-041121a-17.d	Zr3	0.150	126515	832	0.03	61	0.8172	7.5	0.09665	5.7	0.76	639	141	595	32	606	34	98.1
S-041121a-18.d	Zr4	0.214	13334	85	0.40	90	0.8220	7.8	0.09656	5.7	0.73	660	149	594	32	609	36	97.5
S-041121a-19.d	Zr5	0.000	71425	117	0.55	594	6.8243	7.5	0.38381	5.6	0.76	2074	115	2094	101	2089	66	100.7
S-041121a-20.d	Zr6	2.152	140804	966	0.09	416	1.0015	7.5	0.09514	5.7	0.76	1113	132	586	32	705	38	83.2
S-041121a-22.d	Zr8	0.000	138581	258	0.08	158	6.2317	7.5	0.35806	5.8	0.77	2064	116	1973	98	2009	66	97.3
S-041121a-23.d	Zr9	9.764	148638	1885	0.21	1378	0.9291	7.6	0.05165	5.7	0.75	2096	116	325	18	667	37	48.7
S-041121a-24.d	Zr10	5.612	224139	1065	0.08	1096	2.2773	7.5	0.14108	5.6	0.75	1920	118	851	45	1205	53	70.6
Gal21-6																		
S-041121a-25.d	Zr1	0.139	36035	418	0.28	177	0.4057	7.5	0.05423	5.7	0.75	387	150	340	19	346	22	98.5
S-041121a-26.d	Zr2	0.062	117748	1881	0.26	537	0.2969	7.6	0.04183	5.9	0.77	286	153	264	15	264	18	100.1
S-041121a-27.d	Zr3	0.181	106080	1715	0.25	475	0.2960	7.6	0.04077	5.8	0.76	321	153	258	15	263	18	97.8
S-041121a-28.d	Zr4	0.012	32315	453	0.21	123	0.3165	7.6	0.04388	5.7	0.75	281	154	277	15	279	19	99.1
S-041121a-29.d	Zr5	0.287	87237	1403	0.63	956	0.3059	7.6	0.04188	5.8	0.76	364	152	264	15	271	18	97.6
S-041121a-30.d	Zr6	2.632	152293	2558	0.52	1393	0.3867	7.5	0.03898	5.7	0.76	991	133	247	14	332	21	74.3
S-041121a-31.d	Zr7	0.139	52603	821	0.21	203	0.3019	7.6	0.04186	5.7	0.75	313	154	264	15	268	18	98.7
S-041121a-32.d	Zr8	1.120	119186	1754	0.32	697	0.3530	7.5	0.04193	5.6	0.75	622	141	265	15	307	20	86.3
S-041121a-33.d	Zr9	0.756	47345	702	0.30	268	0.3427	8.0	0.04272	5.8	0.73	518	153	270	15	299	21	90.1
S-041121a-34.d	Zr10	2.784	117022	2122	0.66	1231	0.3659	7.5	0.03633	5.7	0.76	1014	134	230	13	317	20	72.7

f206% = $(^{207}\mathrm{Pb}/^{206}\mathrm{Pbm} - {}^{207}\mathrm{Pb}/^{206}\mathrm{Pb}^{*})/(^{207}\mathrm{Pb}/^{206}\mathrm{Pbc} - {}^{207}\mathrm{Pb}/^{206}\mathrm{Pb}^{*}) \times 100$.

%conc = Percentage of concordance: if Age206Pb/238U < 1000 Ma concordance % = $(\mathrm{Age}^{206}\mathrm{Pb}/^{238}\mathrm{U}/\mathrm{Age}^{207}\mathrm{Pb}/^{235}\mathrm{U})^{*}100$; else concordance % = $(\mathrm{Age}^{207}\mathrm{Pb}/^{235}\mathrm{U}/\mathrm{Age}^{207}\mathrm{Pb}/^{206}\mathrm{Pb}) * 100$.

Uncertainties on ages include secondary standard uncertainty propagation as proposed by Horstwood et al. [2016].



Supplementary Figure S1. Wetherill Concordia diagrams displaying all the analyses obtained for samples Lat20-1 and Cam20-3.

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