

Table S1. Summary of new and published thermochronometric ages used for modelling. Depositional ages after SERNAGEOMIN (2003, and references therein).

Sample	Longitude (°)	Latitude (°)	Elevation (m)	Lithology	AHe age (Ma)	AHe 1SD (Ma)	AFT age (Ma)	AFT 1SD (Ma)	ZHe age (Ma)	ZHe 1SD (Ma)	ZFT age (Ma)	ZFT 1SD (Ma)	Stratigraphic age (Ma)	Reference
17PG005	-72.7439	-46.4649	741	granodiorite	-	-	-	-	68.8	11.4	-	-	Cretaceous (Kig) 130 - 70 Ma	this study
17PG006	-72.7390	-46.4652	605	granodiorite	n.r.	-	-	-	71.3	5.5	-	-	Cretaceous (Kig) 130 - 70 Ma	this study
17PG007	-72.7364	-46.4623	444	granodiorite	n.r.	-	-	-	80.8	11.4	-	-	Cretaceous (Kig) 130 - 70 Ma	this study
17PG008	-72.7312	-46.4608	313	granodiorite	-	-	-	-	73.6	13.6	-	-	Cretaceous (Kig) 130 - 70 Ma	this study
17PG009	-72.6113	-46.7971	335	diorite/granodiorite	8.1	1.7	15.9	2.3	n.r.	-	-	-	Cretaceous (Kig) 130 - 70 Ma	this study
17PG010	-72.3602	-46.6290	437	granodiorite	3.2	0.4	28.1	4.3	-	-	-	-	Eocene (Eg?) or J3a 52-33 Ma	this study
17PG011	-72.1010	-46.5693	320	granite	-	-	-	-	118.0	13.0	-	-	Cretaceous to Tertiary	this study
17PG013	-72.7229	-46.4599	203	granodiorite	-	-	-	-	79.5	7.9	-	-	Cretaceous (Kig) 130 - 70 Ma	this study
17PG015	-72.9324	-46.5408	231	granodiorite	4.2	0.3	-	-	9.5	2.2	-	-	Cretaceous (Kig) 130 - 70 Ma	this study
17PG016	-72.9817	-46.5243	190	granodiorite	4.1	0.3	9.6	1.0	15.4	3.1	-	-	Cretaceous (Kig) 130 - 70 Ma	this study
17PG017	-73.0542	-46.5187	133	granodiorite	n.r.	-	-	-	9.2	1.1	-	-	Cretaceous (Kig) 130 - 70 Ma	this study
17PG018	-73.0928	-46.4888	135	granodiorite	-	-	-	-	21.6	5.0	-	-	Cretaceous (Kig) 130 - 70 Ma	this study
17PG019	-73.1498	-46.5010	155	granodiorite	6.1	2.4	-	-	10.1	0.5	-	-	Cretaceous (Kig) 130 - 70 Ma	this study
17PG020	-73.2138	-46.4660	60	granodiorite	3.7	0.8	-	-	18.8	1.5	-	-	Cretaceous (Kig) 130 - 70 Ma	this study
17PG021	-73.2867	-46.3945	28	granodiorite	-	-	-	-	6.9	0.7	-	-	Cretaceous (Kig) 130 - 70 Ma	this study
VG11-LL-10	-73.1351	-46.7438	327	granodiorite	2.7	0.5	4.6	0.5	3.9	0.3	5.8	0.9	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al.
VG12-CM-10	-73.2073	-46.7556	469	granodiorite	2.5	0.7	-	-	5.3	0.6	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al.
VG11-LL-09	-73.2074	-46.7545	562	granodiorite	2.2	1.0	5.9	1.1	5.3	0.5	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al.

Sample	Longitude (°)	Latitude (°)	Elevation (m)	Lithology	AHe age (Ma)	AHe 1SD (Ma)	AFT age (Ma)	AFT 1SD (Ma)	ZHe age (Ma)	ZHe 1SD (Ma)	ZFT age (Ma)	ZFT 1SD (Ma)	Stratigraphic age (Ma)	Reference
VG12-CM-09	-73.2074	-46.7545	562	granodiorite	2.0	0.6	-	-	4.7	0.4	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG11-LL-05	-73.2158	-46.7842	722	granodiorite	3.5	0.4	6.7	0.9	8.1	0.6	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG11-LL-03	-73.2214	-46.7887	995	granodiorite	4.3	0.3	6.5	0.5	7.4	0.4	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG11-LL-08	-73.2221	-46.7392	1005	granodiorite	2.8	0.8	6.5	1.2	6.0	0.5	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG12-CM-08	-73.2216	-46.7390	1016	granodiorite	2.8	0.5	-	-	8.4	1.3	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG11-LL-07	-73.2259	-46.7422	1150	granodiorite	3.7	0.2	-	-	6.3	0.9	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG11-LL-04	-73.2163	-46.7934	1197	granodiorite	4.9	1.0	6.7	1.2	7.7	0.3	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG12-CM-07	-73.2446	-46.7402	1253	granodiorite	5.0	0.8	-	-	6.5	0.6	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG11-LL-06	-73.2357	-46.7416	1351	granodiorite	4.0	0.4	6.7	0.5	6.7	1.0	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG12-CM-06	-73.2551	-46.7406	1434	granodiorite	5.3	0.7	6.6	0.6	5.5	1.1	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG12-CM-05	-73.2666	-46.7379	1645	granodiorite	4.0	1.2	7.7	1.2	9.0	0.6	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG12-CM-04	-73.2713	-46.7425	1843	granodiorite	4.5	1.1	-	-	8.6	0.6	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG12-CM-03	-73.2887	-46.7469	2100	granodiorite	6.8	1.1	-	-	11.7	1.8	14.4	1.8	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG12-CM-02	-73.3027	-46.7367	2254	granodiorite	-	-	-	-	10.7	3.6	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
VG12-CM-01	-73.2959	-46.7349	2436	granodiorite	-	-	-	-	12.2	1.3	-	-	Cretaceous (Kig) 130 - 70 Ma	this study+Georgieva et al. 2016
AG08_33_1	-73.2662	-46.9980	323	granodiorite	6.1	1.9	7.7	0.6	-	-	-	-	Cretaceous (Kig) 130 - 70 Ma	Georgieva et al. 2016
AG08_18_1	-73.2418	-47.0915	1050	granodiorite	5.9	0.4	10.1	0.9	-	-	-	-	Cretaceous (Kig) 130 - 70 Ma	Georgieva et al. 2016
AG08_13_1	-73.2827	-47.0124	1468	granodiorite	6.8	1.2	-	-	-	-	-	-	Cretaceous (Kig) 130 - 70 Ma	Georgieva et al. 2016

Sample	Longitude (°)	Latitude (°)	Elevation (m)	Lithology	AHe age (Ma)	AHe 1SD (Ma)	AFT age (Ma)	AFT 1SD (Ma)	ZHe age (Ma)	ZHe 1SD (Ma)	ZFT age (Ma)	ZFT 1SD (Ma)	Stratigraphic age (Ma)	Reference	
AG08_12_1	-73.2727	-47.0167	1219	granodiorite	6.5	0.7	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Georgieva et al. 2016
AG08_17_1	-73.2404	-47.0985	1382	granodiorite	8.1	0.3	9.5	0.6	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Georgieva et al. 2016
AG08_10_1	-73.2323	-47.0313	579	granodiorite	5.3	0.5	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Georgieva et al. 2016
AG08-34_2	-73.1899	-46.9843	262	granodiorite	4.6	1.1	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Georgieva et al. 2016
LE08_02_1	-73.0447	-46.7287	283	granodiorite	4.3	0.7	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Georgieva et al. 2016
12-Ex-11-1	-73.3091	-46.3621	35	granodiorite	4.2	0.4	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Georgieva et al. 2016
THC8	-74.2080	-47.0067	0	granodiorite	5.8	0.8	14.4	1.7	-	-	66.5	3.5	Cretaceous (Kig)	130 - 70 Ma	Thomson et al. 2001
THC17	-72.2478	-47.0530	0	granodiorite	7.8	0.2	32.0	3.2	-	-	127.4	5.9	Cretaceous (Ksg)	130 - 70 Ma	Thomson et al. 2001
THC23	-72.9953	-46.5187	0	granodiorite	5.4	1.1	9.5	0.7	-	-	72.6	3.0	Cretaceous (Kig)	130 - 70 Ma	Thomson et al. 2001
THC24	-72.7292	-46.5162	0	granodiorite	13.1	0.9	-	-	-	-	95.6	7.0	Cretaceous (Kig)	130 - 70 Ma	Thomson et al. 2001
06PA04	-72.9149	-46.5476	260	granodiorite	4.6	0.5	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Thomson et al 2010
06PA05	-73.1497	-46.5007	151	granodiorite	4.7	0.2	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Thomson et al 2010
06PA06	-73.0934	-46.4886	146	granodiorite	5.6	0.3	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Thomson et al 2010
06PA08	-73.0101	-46.5172	166	granodiorite	4.1	0.2	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Thomson et al 2010
06PA09	-72.9575	-46.5330	216	granodiorite	3.7	0.3	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Thomson et al 2010
anita2	-72.8644	-47.1292	100	metamorphic s	10.4	2.3	-	-	-	-	-	-	DC4		Thomson et al 2010
THC22	-72.7892	-46.9065	330	metamorphic s	9.3	3.3	-	-	-	-	-	-	DC4		Thomson et al 2010
DES23-A	-72.6519	-46.5170	804	granodiorite	9.2	0.9	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Guillaume et al. 2013
DES25-H	-72.6597	-46.4922	600	granodiorite	6.0	0.1	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Guillaume et al. 2013
DES26-M	-72.6660	-46.4705	423	granodiorite	4.6	2.5	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Guillaume et al. 2013

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DES27-N	-72.6740	-46.4618	207	granodiorite	5.6	1.6	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Guillaume et al. 2013
LL01-B	-72.3648	-46.6299	264	granodiorite	3.2	1.9	-	-	-	-	-	-	Miocene	10 Ma	Guillaume et al. 2013
LL02B	-72.3601	-46.6308	466	granodiorite	2.3	0.2	-	-	-	-	-	-	Miocene	10 Ma	Guillaume et al. 2013
LL-03L	-72.3512	-46.6304	779	granodiorite	3.3	0.5	-	-	-	-	-	-	Miocene	10 Ma	Guillaume et al. 2013
LL04A	-72.3560	-46.6305	598	granodiorite	8.8	1.1	-	-	-	-	-	-	Miocene	10 Ma	Guillaume et al. 2013
PATC8-A	-72.6358	-46.5010	555	monzogranite	5.7	0.3	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Guillaume et al. 2013
PATC14-A	-72.7396	-46.5310	770	monzogranite	7.1	0.4	-	-	-	-	-	-	Cretaceous (Kig)	130 - 70 Ma	Guillaume et al. 2013