

SUPPORTING INFORMATION

Continental gabbros in the Dent Blanche Tectonic System (Western Alps): from the pre-Alpine crustal structure of the Adriatic palaeo-margin to the geometry of an alleged subduction interface

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Methods

The petrographical characteristics of the Berrio Gabbro rock types occurring in the Mont Gelé and Regondi Units and of the mafic and ultramafic rocks of the Tsaté Unit are reported below. Table S1 in the Supporting Information is a compilation of the studied samples. The deformation/mineral growth relationships (D_n , M_n) of the Berrio Gabbro rocks are summarized in Figure S1. The main field and micro-scale characters of the mafic and ultramafic rocks from the Berrio Gabbro and of the Tsaté Unit are illustrated in Figure 5, 6, S2, and S3 (Supporting Information). Representative analyses of selected minerals are given in Table S2 and in Tables S3 and S4.

Mineral analyses were performed with a Cameca SX100 electron microprobe (Microsonde Ouest, Brest, France) operating in the wavelength dispersive mode. Operating conditions for spot analyses were set to 15 keV, 20 nA and 10 s counting time on the peak (spot size = 1 μm). The $\phi(\rho Z)$ matrix correction was applied based on Pouchou & Pichoir (1985). Standards were albite (Na, Si), orthoclase (K), corundum (Al), wollastonite (Ca), forsterite (Mg), MnTiO₃ (Mn, Ti), andradite (Fe), Cr₂O₃ with Cr = 68.42 wt.% (Cr), NiO with Ni = 78.58 wt.% (Ni) and apatite (P).

Mineral abbreviations are those used by Whitney & Evans (2010), with mu for muscovite (whatever the Si content) and Mchl for Mg-rich chlorite (Fig. S1). Other symbols (mole/atomic proportions): $X_{\text{Mg}} = \text{Mg}/(\text{Mg} + \text{Fe})$ (amphibole, clinopyroxene, chlorite, serpentine); per formula unit (p.f.u.); weight per cent (wt%), mole per cent (mol.%), Mg# = (molar Mg/(Mg+Fe_T)).

Major and minor elements were determined in whole-rock samples by ICP-AES (CRPG, Nancy) and incompatible trace elements by ICP-MS, respectively. Bulk-rock glasses were prepared by mixing appropriate proportions (1:5) of fine-grained rock powder with di-lithium tetraborate.

Details about the method used for the analyses are available in Carignan *et al.* (2001).

Reference

- Carignan, J., Hild, P., Mevelle, G., Morel, J. & Yeghicheyan, D. 2001. Routine analyses of trace elements in geological samples using flow injection and low pressure on-line liquid chromatography coupled to ICP-MS: a study of geochemical reference materials, BR, DR-N, UB-N, AN-G and GH. *Geostandards Newsletters*, **25**, 187-198.
- Pouchou, J. L. & Pichoir, F. 1985. "PAP" phi-rho-Z procedure for improved quantitative microanalysis. In: Armstrong, J.T. (eds) *Microbeam Analysis*. San Francisco Press, San Francisco, 104-106.
- Whitney, D. L. & Evans, B. W. 2010. Abbreviation for names of rock-forming minerals. *American Mineralogist*, **95**, 185-187.

Sample number	Rock type	Unit	Location		Long Lat
			UTM European Datum 1950	Metres	
22	Pl-Wehrlite	Mont Gelè (DB)	370,367.197	5,081,014.167	N 45° 52' 14" E 7° 19' 47"
42	Wehrlite	Mont Gelè (DB)	369,686.383	5,079,523.120	N 45° 51' 25" E 7° 19' 17"
25	Clinopyroxenite	Mont Gelè (DB)	370,415.061	5,081,007.891	N 45° 52' 14" E 7° 19' 49"
26	Clinopyroxenite	Mont Gelè (DB)	370,447.618	5,080,989.043	N 45° 52' 13" E 7° 19' 51"
29	Clinopyroxenite	Mont Gelè (DB)	370,556.482	5,080,936.579	N 45° 52' 11" E 7° 19' 56"
1502	Hornblendite	Mont Gelè (DB)	372,028.148	5,082,818.493	N 45° 53' 13" E 7° 21' 02"
1503	Hornblendite	Mont Gelè (DB)	372,028.148	5,082,818.493	N 45° 53' 13" E 7° 21' 02"
1504	Hornblendite	Mont Gelè (DB)	372,028.148	5,082,818.493	N 45° 53' 13" E 7° 21' 02"
3	Leucocratic gabbro	Mont Gelè (DB)	371,048.630	5,081,339.523	N 45° 52' 25" E 7° 20' 18"
4	Leucocratic gabbro	Mont Gelè (DB)	371,048.630	5,081,339.523	N 45° 52' 25" E 7° 20' 18"
21	Leucocratic gabbro	Mont Gelè (DB)	370,367.197	5,081,014.167	N 45° 52' 13" E 7° 19' 47"
24	Leucocratic gabbro	Mont Gelè (DB)	370,415.061	5,081,007.891	N 45° 52' 14" E 7° 19' 49"
45	Leucocratic gabbro	Mont Gelè (DB)	370,135.250	5,080,068.295	N 45° 51' 43" E 7° 19' 37"
1537	Leucocratic gabbro	Mont Gelè (DB)	372,568.521	5,083,478.161	N 45° 53' 35" E 7° 21' 26"
1	Mesocratic gabbro	Mont Gelè (DB)	371,257.197	5,081,379.201	N 45° 52' 25" E 7° 20' 28"
2	Mesocratic gabbro	Mont Gelè (DB)	371,254.551	5,081,368.616	N 45° 52' 25" E 7° 20' 27"
20	Mesocratic gabbro	Mont Gelè (DB)	371,640.787	5,082,212.561	N 45° 52' 53" E 7° 20' 45"
39	Mesocratic gabbro	Mont Gelè (DB)	369,411.216	5,079,267.003	N 45° 51' 15" E 7° 19' 04"
44	Mesocratic gabbro	Mont Gelè (DB)	369,633.466	5,079,472.320	N 45° 51' 23" E 7° 19' 15"
1505	Mesocratic gabbro	Mont Gelè (DB)	369,377.184	5,079,268.898	N 45° 51' 16" E 7° 19' 02"
1512	Mesocratic gabbro	Mont Gelè (DB)	371,064.161	5,082,017.894	N 45° 52' 46" E 7° 20' 18"
1531	Mesocratic gabbro	Mont Gelè (DB)	372,610.624	5,083,455.109	N 45° 53' 34" E 7° 21' 28"
1532	Mesocratic gabbro	Mont Gelè (DB)	372,610.624	5,083,455.109	N 45° 53' 34" E 7° 21' 28"
30	Epidosite	Mont Gelè (DB)	370,439.918	5,080,958.223	N 45° 52' 11" E 7° 19' 50"
DBL 26	Mesocratic gabbro	Cervino (DB)	near the pluviometer (3400 m) between the Oriondé and the Leone Hill		
DBL 28	Mesocratic gabbro	Cervino (DB)	near the "Sasso dello zucchero" (3300 m), between the Oriondé and the Leone Hill		
DBL 32	Metabasic dyke	Cervino (DB)	northward the Oriondé (3160-3120 m)		
DBL 229	Wehrlite	Cervino (DB)	boulder from the landslide fallen from the Matterhorn Southern wall (~3559 m) on the Cervino glacier		
DBL 232	Leucocratic gabbro	Cervino (DB)	boulder from the landslide fallen from the Matterhorn Southern wall (~3559 m) on the Cervino glacier		
DBL 2051	Mesocratic gabbro	Cervino (DB)	right side of the Pic Tyndal glacier		
DBL 1834	Mesocratic gabbro	Cervino (DB)	boulder on the Leone glacier		
DBL 1821	Mesocratic gabbro	Cervino (DB)	boulder on the Leone glacier		
DBL 1794	Mesocratic gabbro	Cervino (DB)	Leone Hill		
36	Gabbro	Tsaté unit (TU)	372,512.917	5,085,657.496	N 45° 54' 46" E 7° 21' 2"
37	Gabbro	Tsaté unit (TU)	372,512.917	5,085,657.496	N 45° 54' 46" E 7° 21' 2"
35	Serpentinite	Tsaté unit (TU)	372,586.585	5,085,449.416	N 45° 54' 39" E 7° 21' 26"

Table S1. Location of studied samples from the Arolla Series (Dent Blanche nappe) and Tsaté Unit.

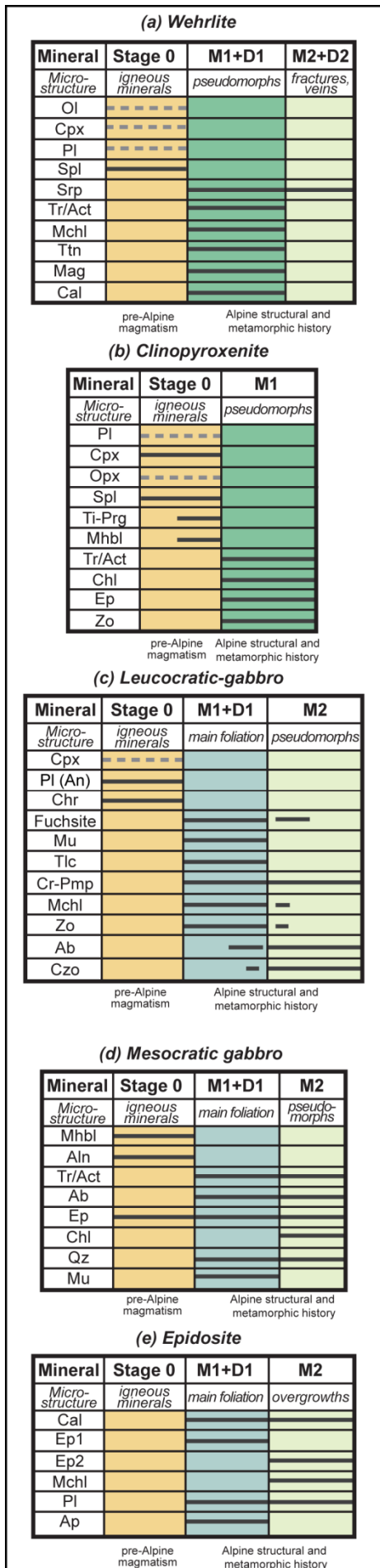


Figure S1. Deformation/mineral growth relationships in the rocks of the BG. (a) Pl±wehrlite. (b) Clinopyroxenite. (c) Leucocratic gabbro. (d) Mesocratic gabbro. (e) Epidosite.

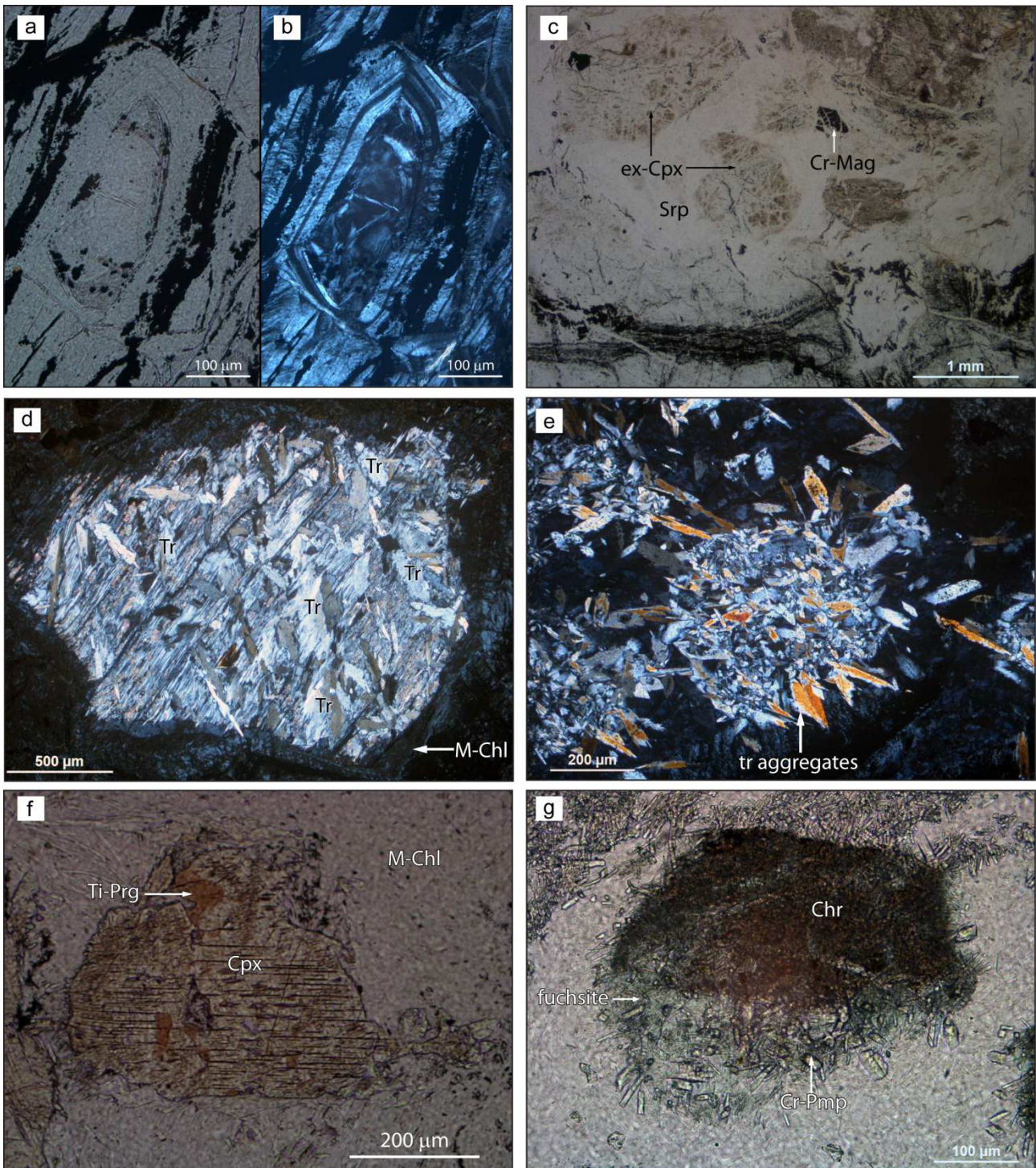


Figure S2. Thin section photomicrographs from the Berrio Gabbro ultramafic and mafic rocks. **(a)** Lizardite pseudomorphing olivine with mesh texture in a wehrlite (sample 22, plane polarised light) (PPL). **(b)** The same as (a) under CPL **(c)** Ex-clinopyroxene in a wehrlite, replaced by aggregates of tremolite – calcite – Mg-chlorite - titanite. Cr-spinel is replaced by Cr-magnetite and Mg-chlorite (sample 42, PPL). **(d)** Clinopyroxene replaced by pseudomorphic aggregates of tremolite, Mg-rich chlorite and fine-grained calcite (not indicated in the photograph due to its small size) (sample 42, CPL). **(e)** Tremolite replacing unknown intercumulus phase in a wehrlite (sample 22, CPL). **(f)** Clinopyroxene in a clinopyroxenite with small interstitial Ti-pargasite (sample 29, PPL). **(g)** Chromite pseudomorph partially preserving chromite relicts (with up to 37 wt.% Cr_2O_3) largely replaced by chromian pumpellyite and fuchsite (sample 21, PPL).

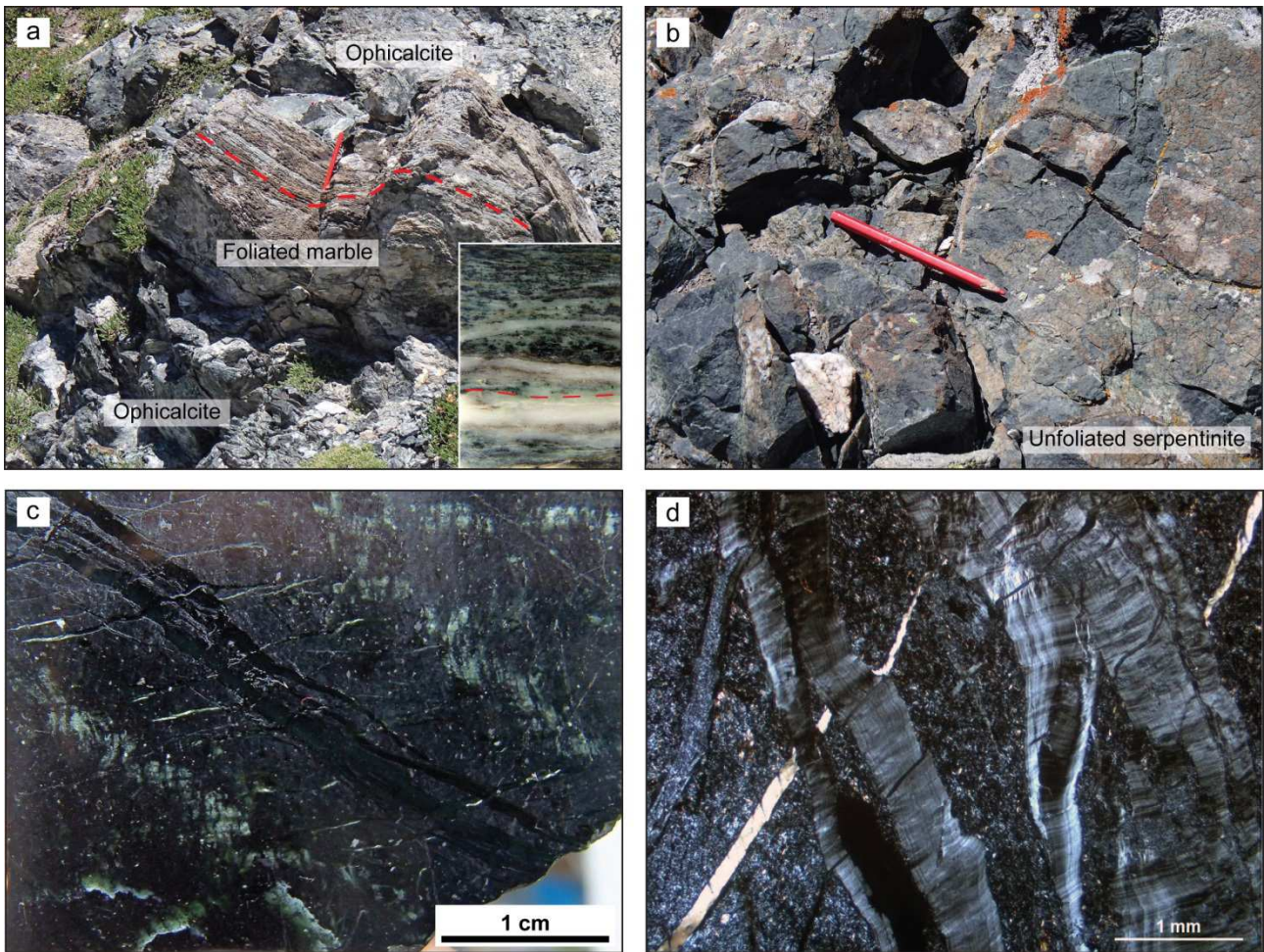


Figure S3. Field aspects of rocks from the Tsaté Unit at various scale. UTM ED 1950 coordinates for field photograph are given. **(a)** Field aspect of ophicalcite with foliated marble layers (369528/5081489). The inset shows the polished surface of a foliated marble. **(b)** Field aspect of massive serpentinite (369546/5081461) **(c)** Polished surface of a massive serpentinite (sample 35; 372586/5085449), characterized by late serpentinite veins. **(d)** Thin section photomicrograph of a massive serpentinite with serpentinite veins (sample 35, crossed polarised light) (CPL). Serpentine occurs as very fine-grained crystals.

Mineral / Zone	Cpx 1/21 core	Cpx 1/15 rim	Cpx 2/8 rim	Cpx 2/9 rim	Cpx 2/16 core	Cpx 2/17 core	Cpx 76/1	Mhbl 43/8	Mhbl 1/1	Mhbl 9/1	Ti-rich Prg 71/1	Ti-rich Prg 85/1
Sample	26	26	26	26	26	26	29	26	26	20	29	29
SiO ₂	51.52	51.59	51.63	51.40	50.87	51.17	50.84	50.15	50.19	48.38	44.17	43.17
TiO ₂	0.72	0.59	0.67	0.57	0.62	0.60	0.51	0.42	0.47	0.60	2.30	2.06
Cr ₂ O ₃	0.20	0.28	0.31	0.33	0.33	0.36	1.07	0.35	0.48	0.00	0.59	0.59
Al ₂ O ₃	3.75	3.75	4.09	4.04	4.02	3.98	4.23	6.12	6.30	8.70	11.10	12.62
FeO	3.98	3.78	3.82	4.03	3.95	3.85	4.19	6.94	8.19	10.29	7.50	7.05
MnO	0.16	0.10	0.16	0.10	0.14	0.14	0.08	0.13	0.18	0.27	0.09	0.02
NiO	0.01	0.00	0.00	0.00	0.04	0.01	0.01	0.07	0.02	0.00	0.04	0.05
MgO	15.60	15.61	15.40	15.43	15.86	15.46	14.95	18.73	17.45	14.80	15.74	15.92
CaO	23.60	23.55	23.38	23.25	23.09	23.35	23.10	12.77	12.97	12.44	12.04	12.12
Na ₂ O	0.41	0.48	0.43	0.42	0.46	0.42	0.46	1.33	1.37	1.07	2.27	2.62
K ₂ O	0.01	0.02	0.00	0.01	0.00	0.01	0.02	0.07	0.07	0.26	0.73	1.00
P ₂ O ₅	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	99.95	99.73	99.89	99.59	99.38	99.35	99.47	97.10	97.69	96.79	96.57	97.22
Si	1.88	1.89	1.89	1.89	1.87	1.88	1.87	7.13	7.15	7.03	6.48	6.30
Ti	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.05	0.05	0.07	0.25	0.23
Cr	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.04	0.05	0.00	0.07	0.07
Al	0.16	0.16	0.18	0.17	0.17	0.17	0.18	1.02	1.06	1.49	1.92	2.17
Fe ³⁺	0.06	0.06	0.03	0.04	0.08	0.05	0.05	0.21	0.09	0.00	0.00	0.00
Fe ²⁺	0.07	0.06	0.09	0.08	0.04	0.07	0.08	0.62	0.89	1.25	0.92	0.86
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.03	0.01	0.00
Ni	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
Mg	0.85	0.85	0.84	0.84	0.87	0.85	0.82	3.97	3.71	3.20	3.44	3.46
Ca	0.92	0.92	0.92	0.91	0.91	0.92	0.91	1.95	1.98	1.94	1.89	1.90
Na	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.37	0.38	0.30	0.64	0.74
K	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.05	0.14	0.19
P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	4.00	4.00	4.00	4.00	4.00	4.00	4.00	15.38	15.39	15.35	15.78	15.93
^{IV} Al	0.12	0.11	0.11	0.11	0.13	0.12	0.13	0.87	0.85	0.97	1.52	1.70
^{VI} Al	0.04	0.05	0.07	0.06	0.04	0.05	0.06	0.15	0.21	0.51	0.40	0.48
Mg#	92.86	93.67	90.37	91.32	95.82	92.81	90.74					
X _{Mg}	0.94	0.94	0.94	0.94	0.94	0.94	0.91	0.87	0.81	0.72	0.79	0.80

Table S2. Representative mineral analyses from ultramafic cumulates and gabbros from the Berrio Gabbro.

Mineral / Zone	Srp 51/1	Srp 56/1	Chl 21/1	Chl 26/1	Chl 17/1	Tr 24/1	Tr 111/1	Ttn 55/1	Tr 2/30	Tr 23/1	Act 2/6	Ep 46/1 core	Ep 46/1 rim	Cal 24/1
Sample	42	42	42	42	25	42	22	42	26	25	26	25	25	42
SiO ₂	36.94	40.13	37.41	38.38	34.92	57.40	58.65	29.91	56.65	58.18	55.53	38.90	38.13	1.32
TiO ₂	0.01	0.05	0.00	0.08	0.15	0.04	0.02	40.22	0.07	0.05	0.10	0.00	0.00	0.00
Cr ₂ O ₃	3.17	0.11	0.33	0.29	0.87	0.42	0.00	0.10	0.00	0.00	0.21	0.00	0.00	0.00
Al ₂ O ₃	6.66	4.10	8.23	5.36	12.01	0.56	0.08	0.06	0.89	0.02	2.43	32.51	27.79	0.02
FeO	5.48	5.88	5.71	6.21	8.61	2.01	2.63	0.87	4.58	3.48	3.58	1.67	6.91	0.30
MnO	0.13	0.15	0.12	0.16	0.07	0.13	0.10	0.01	0.11	0.17	0.11	0.13	0.04	0.30
NiO	0.04	0.10	0.05	0.06	0.05	0.02	0.08	0.01	0.00	0.00	0.00	0.04	0.00	0.00
MgO	34.25	35.77	33.90	35.31	29.81	22.80	22.98	0.00	22.00	22.57	20.96	0.08	0.04	1.44
CaO	0.10	0.13	0.24	0.08	1.16	13.04	13.89	28.10	13.06	13.75	13.36	24.01	23.77	55.32
Na ₂ O	0.00	0.00	0.00	0.02	0.16	0.32	0.00	0.00	0.34	0.03	0.72	0.02	0.00	0.02
K ₂ O	0.02	0.00	0.00	0.00	0.01	0.06	0.01	0.00	0.03	0.00	0.01	0.00	0.00	0.00
P ₂ O ₅	0.00	0.00	0.02	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
Total	86.78	86.40	86.02	85.96	87.84	96.79	98.45	99.29	97.72	98.25	97.01	97.35	96.70	58.75
Si	1.78	1.92	7.20	7.42	6.72	7.96	7.98	0.99	7.84	7.96	7.76	2.99	3.04	58.75
Ti	0.00	0.00	0.00	0.01	0.02	0.00	0.00	1.00	0.01	0.01	0.01	0.00	0.00	0.02
Cr	0.12	0.00	0.05	0.04	0.13	0.05	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
Al	0.38	0.23	1.87	1.22	2.72	0.09	0.01	0.00	0.15	0.00	0.40	2.94	2.61	0.00
Fe ³⁺	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.07	0.06	0.00	0.00	0.00	0.00
Fe ²⁺	0.22	0.24	0.92	1.00	1.39	0.23	0.28	0.02	0.46	0.34	0.42	0.11	0.11	0.00
Mn	0.01	0.01	0.02	0.03	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.00
Ni	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mg	2.46	2.55	9.73	10.18	8.55	4.71	4.66	0.00	4.53	4.60	4.37	0.01	0.00	0.00
Ca	0.00	0.01	0.05	0.02	0.24	1.94	2.02	0.99	1.94	2.01	2.00	1.98	2.03	0.03
Na	0.00	0.00	0.00	0.01	0.06	0.08	0.00	0.00	0.09	0.01	0.19	0.00	0.00	0.94
K	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	4.97	4.96	19.84	19.94	19.86	15.10	15.00	3.01	15.10	15.01	15.20	8.04	8.15	2.00
^{IV} Al	0.22	0.08							0.15	0.00	0.65			
^{VI} Al	0.16	0.15							0.00	0.00	0.16			
Mg#														
X _{Mg}	0.92	0.92	0.91	0.91	0.86	0.95	0.94		0.91	0.93	0.81			0.89

Table S3. Representative Alpine mineral analyses from the ultramafic rocks of the Berrio Gabbro.

Mineral	Ms 64/1	Ms 22/1	Ms 35/1	Ms 50/1	Cr- Pmp 13/1	Cr- Pmp 12/1	Cr- Pmp 32/1	Chl 71/1	Chl 72/1	Zo 40/1	Zo 41/1	Ab 10/1	Act 10/1	Tr 17/1
Sample	21	21	21	21	21	21	21	21	21	21	21	4	20	20
SiO ₂	49.73	50.53	51.14	50.40	36.69	30.70	36.01	29.06	29.56	38.35	38.62	68.39	53.55	56.81
TiO ₂	0.02	0.06	0.01	0.03	0.10	0.13	0.06	0.02	0.04	0.06	0.02	0.00	0.18	0.00
Cr ₂ O ₃	5.50	2.88	0.98	0.63	7.10	16.40	11.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Al ₂ O ₃	24.49	26.24	28.19	29.74	21.10	17.89	17.88	21.36	21.70	27.82	28.70	19.75	3.53	1.14
FeO	0.93	0.96	1.10	0.95	1.21	5.22	1.34	7.90	7.54	6.93	6.01	0.01	8.47	5.14
MnO	0.00	0.05	0.00	0.00	0.11	0.33	0.05	0.08	0.09	0.02	0.02	0.02	0.27	0.26
NiO	0.05	0.01	0.09	0.13	0.00	0.04	0.00	27.85	0.08	0.00	0.00	0.00	0.04	0.00
MgO	4.28	4.80	3.98	3.50	3.58	3.04	3.52	0.02	27.82	0.02	0.04	0.00	18.07	20.82
CaO	0.07	0.03	0.10	0.04	22.24	19.06	22.05	0.00	0.04	23.67	23.74	0.32	12.69	12.41
Na ₂ O	0.11	0.15	0.21	0.23	0.10	0.12	0.16	0.01	0.01	0.01	0.01	11.42	0.62	0.52
K ₂ O	6.72	7.03	8.37	8.42	0.05	0.02	0.06	0.00	0.00	0.00	0.00	0.03	0.05	0.01
P ₂ O ₅	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.08	0.02	0.02	0.05	0.00	0.00	0.00
Total	91.92	92.72	94.16	94.11	92.30	92.94	92.19	86.38	86.88	96.87	97.20	99.94	97.48	97.12
Si	3.40	3.40	3.39	3.34	3.05	2.85	3.12	5.64	5.69	2.990	2.99	2.99	7.60	7.96
Ti	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00
Cr	0.30	0.15	0.05	0.03	0.23	0.60	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Al	1.97	2.08	2.20	2.32	2.07	1.95	1.83	4.89	4.92	2.56	2.62	1.02	0.59	0.19
Fe ³⁺	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.39	0.00	0.00	0.00
Fe ²⁺	0.05	0.05	0.06	0.05	0.08	0.40	0.10	1.28	1.21	0.00	0.00	0.00	1.01	0.60
Mn	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.01	0.01	0.00	0.00	0.00	0.03	0.03
Ni	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	1.00	0.00	0.00
Mg	0.44	0.48	0.39	0.35	0.44	0.42	0.46	8.06	7.98	0.00	0.00	0.00	3.82	4.35
Ca	0.01	0.00	0.01	0.00	1.98	1.89	2.05	0.00	0.01	1.98	1.97	0.02	1.93	1.86
Na	0.01	0.02	0.03	0.03	0.02	0.02	0.03	0.00	0.00	0.05	0.01	0.97	0.17	0.14
K	0.59	0.60	0.71	0.71	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	6.77	6.80	6.85	6.85	7.91	8.18	7.97	19.91	19.84	8.04	7.99	4.99	15.18	15.14
^{IV} Al	0.60	0.60	0.61	0.66	0.95	1.15	0.88						0.40	0.04
^{VI} Al	1.37	1.48	1.59	1.66	1.12	0.80	0.95						0.19	0.15
X _{Mg}								0.86	0.87				0.79	0.88

Table S4. Representative Alpine mineral analyses from the leucocratic and mesocratic gabbros of the Berrio Gabbro.

Berrio									
Rock type	Pl-Wehrlite	Wehrlite	Clino pyroxenite	Clino pyroxenite	Clino pyroxenite	Hornblendite	Hornblendite	Hornblendite	Leucocratic gabbro
Sample n°	22	42	25	26	29	1502	1503	1504	24
SiO ₂	40.43	36.87	41.29	44.63	41.37	42.08	36.41	37.56	45.45
Al ₂ O ₃	7.85	4.14	8.22	9.59	10.72	17.52	16.30	12.00	28.66
Fe ₂ O ₃	9.89	12.97	9.61	7.47	9.64	13.01	18.27	21.92	0.97
MnO	0.10	0.15	0.11	0.13	0.15	0.12	0.14	0.15	0.02
MgO	27.74	32.36	26.19	19.89	22.44	7.49	6.52	9.01	1.99
CaO	4.54	1.31	5.35	11.87	8.23	11.38	14.72	10.45	16.41
Na ₂ O	0.03	0.01	0.07	0.43	0.21	1.88	0.39	0.72	2.14
K ₂ O	bdl	bdl	bdl	0.04	0.02	0.73	bdl	bdl	0.69
TiO ₂	0.09	0.18	0.19	0.25	0.28	0.99	1.99	2.34	0.06
P ₂ O ₅	bdl	0.04	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PF	8.44	11.02	8.44	4.97	6.11	3.79	3.98	5.48	2.38
Total	99.12	99.05	99.48	99.26	99.16	98.98	98.72	99.63	98.76
Mg#	0.85	0.83	0.84	0.84	0.82	0.53	0.41	0.45	0.80
<i>Trace elements (ppm)</i>									
As	bdl	1.61	bdl	bdl	bdl	bdl	1.51	1.91	bdl
Ba	3.91	17	2.77	5.10	2.11	217	22	11	50
Be	bdl	bdl	bdl	bdl	bdl	0.42	0.47	0.59	bdl
Bi	0.11	0.15	0.28	bdl	1.15	bdl	bdl	0.07	0.24
Cd	bdl	bdl	bdl	bdl	0.13	0.07	0.11	0.05	bdl
Co	94	112	88	62	87	38	66	92	8.24
Cr	1860	1378	1208	1464	1412	103	45	15	77
Cs	0.57	0.97	0.12	0.19	bdl	0.15	0.04	0.08	0.24
Cu	44	14	12	75	42	39	87	61	bdl
Ga	5.47	4.48	6.43	7.00	7.97	21	26	21	16
Ge	1.08	1.06	1.17	1.35	1.06	1.12	1.76	1.26	0.75
Hf	0.14	0.44	0.30	0.38	0.49	0.57	0.69	0.98	0.07
In	bdl	bdl	bdl	bdl	bdl	0.07	0.07	0.09	bdl
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Nb	0.10	0.54	bdl	bdl	0.54	0.58	1.60	2.20	0.11
Ni	758	846	520	369	717	15	16	20	42
Pb	0.87	4.53	bdl	1.21	5.05	2.10	3.92	3.13	1.61
Rb	0.69	0.73	bdl	1.41	bdl	19	0.60	0.64	30
Sc	14	19	30	41	25	76	63	94	2.52
Sb	bdl	1.06	0.60	0.31	bdl	0.80	1.91	2.58	bdl
Sn	bdl	bdl	bdl	0.49	0.69	bdl	bdl	bdl	bdl
Sr	15	9.94	25	116	16	377	557	327	866
Ta	bdl	0.04	bdl	bdl	0.04	0.08	0.19	0.19	0.02
Th	bdl	0.28	bdl	bdl	0.21	0.07	0.26	0.21	bdl
U	bdl	0.05	bdl	bdl	0.05	0.04	0.15	0.14	0.04
V	36	48	66	97	68	575	1045	1076	9.32
W	2.95	4.04	1.34	5.61	4.94	42	46	39	43
Y	1.84	4.36	4.78	6.76	5.69	9.18	9.24	14	0.81
Zn	69	73	75	54	112	87	86	113	11
Zr	3.82	16	6.87	8.63	15	14	20	25	2.58
<i>REE elements (ppm)</i>									
La	0.47	1.80	0.69	0.79	1.84	1.89	3.19	4.07	1.34
Ce	1.35	4.33	2.35	2.59	4.74	5.39	8.55	12	2.58
Pr	0.22	0.64	0.44	0.51	0.74	0.92	1.27	1.99	0.32
Nd	1.05	2.97	2.46	2.89	3.57	5.14	6.01	10	1.33
Sm	0.33	0.82	0.82	1.02	1.00	1.67	1.72	3.09	0.24
Eu	0.15	0.24	0.27	0.40	0.33	0.63	0.57	0.82	0.34
Gd	0.33	0.81	0.92	1.17	1.05	1.77	1.72	2.96	0.20
Tb	0.06	0.13	0.15	0.20	0.17	0.30	0.28	0.50	0.03
Dy	0.37	0.83	0.97	1.29	1.10	1.90	1.76	3.02	0.18
Ho	0.07	0.17	0.20	0.27	0.23	0.38	0.35	0.59	0.03
Er	0.20	0.44	0.50	0.69	0.60	0.94	0.93	1.45	0.08
Tm	0.03	0.06	0.07	0.09	0.09	0.12	0.13	0.19	0.01
Yb	0.17	0.43	0.4	0.60	0.55	0.76	0.81	1.22	0.07
Lu	0.03	0.07	0.06	0.09	0.08	0.10	0.12	0.17	0.01
ΣREE	4.81	14	10	13	16	15	16	26	6.77

Table S5. Whole-rock major and trace-elements compositions of the Berrio and Cervino Gabbros and of the Tsaté Unit. bdl = below detection limit.

Berrio									
Rock type	Leucocratic gabbro	Leucocratic gabbro	Leucocratic gabbro	Leucocratic gabbro	Leucocratic gabbro	Mesocratic gabbro	Mesocratic gabbro	Mesocratic gabbro	Mesocratic gabbro
Sample n°	4	3	45	21	1537	20	1512	44	1
SiO ₂	45.63	45.76	44.12	42.98	45.17	48.74	51.17	45.67	50.70
Al ₂ O ₃	28.36	29.12	22.04	25.43	25.12	17.52	16.27	23.69	16.20
Fe ₂ O ₃	1.39	0.90	3.99	2.63	4.13	6.41	5.57	3.27	4.55
MnO	0.02	0.01	0.05	0.04	0.06	0.12	0.10	0.06	0.12
MgO	2.56	1.65	10.45	6.84	5.66	9.15	9.09	5.47	9.69
CaO	13.65	13.72	9.46	12.06	8.82	9.62	11.37	13.18	12.14
Na ₂ O	2.67	2.30	2.35	1.86	1.83	2.32	2.53	3.25	1.73
K ₂ O	1.49	2.37	1.15	1.96	3.82	1.67	0.24	0.41	1.84
TiO ₂	0.06	bdl	0.10	bdl	bdl	0.42	0.35	0.27	0.28
P ₂ O ₅	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PF	2.85	2.90	5.00	5.36	4.48	3.71	2.80	3.92	3.22
Total	98.68	98.73	98.71	99.15	99.07	99.66	99.48	99.20	100.46
Mg#	0.79	0.78	0.84	0.84	0.73	0.74	0.76	0.77	0.81
<i>Trace elements (ppm)</i>									
As	bdl	bdl	bdl	1.10	0.33	bdl	1.26	bdl	0.35
Ba	85	96	132	126	1902	225	39	73	300
Be	0.53	0.42	0.52	0.27	0.64	0.65	0.68	bdl	0.73
Bi	bdl	0.06	bdl	bdl	0.20	bdl	bdl	0.15	0.07
Cd	bdl	0.09	bdl	0.06	0.09	bdl	0.05	bdl	0.11
Co	13	11	37	27	25	28	27	21	32
Cr	654	832	321	494	211	109	225	542	673
Cs	0.50	0.85	0.25	0.91	0.98	0.26	0.10	0.22	0.64
Cu	bdl	bdl	19	35	29	13	10	5.94	61
Ga	15	15	12	13	17	16	15	15	12
Ge	0.65	0.49	0.97	0.69	0.64	1.53	1.19	1.21	1.52
Hf	0.10	0.03	0.19	0.05	0.14	0.63	0.50	0.52	0.39
In	bdl	bdl	bdl	bdl	bdl	bdl	0.04	bdl	0.03
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Nb	0.84	0.61	0.35	0.19	0.26	0.77	0.72	0.81	0.10
Ni	90	62	344	170	50	123	32	99	69
Pb	1.67	5.30	9.02	5.42	2.03	4.42	3.56	7.10	5.01
Rb	66	99	35	81	99	50	7.59	14	70
Sc	1.23	bdl	3.92	bdl	9.07	29	34	17	51
Sb	bdl	0.98	bdl	0.47	0.10	bdl	0.23	1.23	1.41
Sn	0.49	bdl	bdl	bdl	bdl	0.70	bdl	bdl	bdl
Sr	1029	1111	400	364	297	385	508	574	441
Ta	0.13	0.27	0.03	0.07	0.05	0.06	0.13	0.06	0.08
Th	0.73	0.12	0.15	0.14	0.07	0.20	0.44	0.27	0.06
U	0.41	0.09	0.29	0.05	0.08	0.14	0.17	0.08	0.04
V	10	11	14	8.50	28	101	124	57	129
W	49	231	15	53	33	21	59	23	68
Y	1.43	1.17	1.57	0.64	1.46	8.03	9.26	5.27	8.07
Zn	24	38	39	24	44	54	45	35	50
Zr	2.92	5.01	7.37	3.11	4.73	19	14	19	9.85
<i>REE elements (ppm)</i>									
La	1.67	1.95	1.67	1.24	1.33	2.97	3.71	2.53	1.35
Ce	3.30	3.64	3.47	2.43	2.74	7.13	9.20	6.04	3.85
Pr	0.42	0.45	0.46	0.28	0.34	1.07	1.35	0.85	0.66
Nd	1.66	1.75	1.95	1.11	1.52	5.14	6.48	3.82	3.61
Sm	0.37	0.37	0.41	0.20	0.36	1.41	1.84	0.98	1.27
Eu	0.35	0.41	0.33	0.32	0.28	0.71	0.73	0.52	0.57
Gd	0.31	0.29	0.36	0.17	0.33	1.47	1.83	0.98	1.40
Tb	0.04	0.04	0.05	0.02	0.05	0.23	0.29	0.16	0.25
Dy	0.27	0.23	0.30	0.12	0.30	1.52	1.84	0.99	1.59
Ho	0.05	0.05	0.06	0.02	0.06	0.32	0.37	0.20	0.33
Er	0.13	0.11	0.16	0.06	0.15	0.85	0.95	0.54	0.84
Tm	0.02	0.01	0.02	0.01	0.02	0.12	0.13	0.08	0.12
Yb	0.13	0.09	0.14	0.05	0.13	0.78	0.87	0.48	0.74
Lu	0.02	0.01	0.02	0.01	0.02	0.12	0.13	0.07	0.10
ΣREE	8.74	3.82	9.41	2.38	3.58	24	17	18	11

Table S5. Continued.

Rock type Sample n°	Berrio					Cervino			
	Mesocratic gabbro	Mesocratic gabbro	Mesocratic gabbro	Mesocratic gabbro	Mesocratic gabbro	Mesocratic gabbro	Mesocratic gabbro	Metabasic dyke	Wehrlite
	39	1505	2	1531	1532	DBL 26	DBL 28	DBL 32	DBL 229
SiO ₂	47.91	50.20	47.98	46.52	45.01	49.03	47.99	47.85	39.58
Al ₂ O ₃	22.15	18.18	17.36	17.80	19.43	16.77	16.85	17.71	10.62
Fe ₂ O ₃	3.22	4.55	4.19	7.96	8.17	6.45	6.72	8.80	10.55
MnO	0.06	0.09	0.09	0.13	0.12	0.10	0.13	0.12	0.13
MgO	6.34	9.15	9.89	9.09	8.16	9.48	8.96	7.08	25.18
CaO	13.42	10.18	13.15	9.95	10.79	10.29	11.47	8.85	5.42
Na ₂ O	2.16	3.21	2.45	2.12	1.72	2.61	2.59	2.39	0.10
K ₂ O	0.09	0.38	0.17	1.50	1.77	0.39	0.57	bdl	bdl
TiO ₂	0.38	0.27	0.16	0.38	0.36	0.86	0.91	1.70	0.10
P ₂ O ₅	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.28	bdl
PF	3.56	3.14	3.43	3.57	3.78	2.87	2.54	4.11	7.44
Total	99.29	99.34	98.86	99.01	99.31	98.86	98.72	98.89	99.12
Mg#	0.80	0.80	0.82	0.69	0.66	0.74	0.73	0.62	0.83
<i>Trace elements (ppm)</i>									
As	bdl	0.29	0.20	0.24	0.20	0.31	0.95	0.37	bdl
Ba	17	117	36	533	641	90	97	8.31	9.59
Be	0.61	0.42	0.94	0.75	0.82	0.40	0.91	0.59	0.11
Bi	bdl	0.07	0.05	bdl	0.37	bdl	bdl	0.13	bdl
Cd	0.05	0.04	0.12	0.07	0.09	0.09	0.16	0.16	0.12
Co	24	25	32	41	33	47	36	52	95
Cr	628	160	607	208	207	263	598	84	277
Cs	0.05	0.37	0.06	0.29	0.34	0.27	0.32	0.14	0.73
Cu	19	7.91	7.99	10	bdl	75	120	70	8.75
Ga	14	13	12	15	18	14	15	21	6.82
Ge	0.95	1.35	1.74	1.23	1.30	1.23	1.13	1.59	0.79
Hf	0.55	0.30	0.30	0.94	1.89	1.07	1.52	4.33	0.19
In	0.03	0.03	0.02	0.05	0.04	0.04	0.05	0.09	0.02
Mo	bdl	bdl	bdl	bdl	bdl	0.59	bdl	1.26	bdl
Nb	0.97	0.27	0.81	1.81	1.73	3.41	2.52	9.73	0.23
Ni	108	96	218	30	28	104	87	44	527
Pb	2.18	2.14	26	2.91	4.06	1.59	3.44	7.90	2.73
Rb	2.50	10	5.30	43	50	7.25	17	0.98	2.57
Sc	20	26	16	46	45	34	40	31	7.64
Sb	0.10	0.33	0.48	0.08	0.10	0.06	0.46	0.29	bdl
Sn	bdl	bdl	bdl	bdl	bdl	bdl	bdl	2.30	bdl
Sr	484	394	431	275	344	358	391	449	78
Ta	0.27	0.09	0.18	0.23	0.22	0.57	0.23	1.17	0.02
Th	0.27	0.08	0.55	1.12	1.03	0.45	1.22	3.38	0.06
U	0.23	0.08	0.47	0.46	0.52	0.17	0.35	1.13	0.02
V	75	83	50	132	146	144	161	205	21
W	192	73	63	44	46	85	0.78	94	bdl
Y	6.76	5.46	4.34	12	12	15	16	32	1.95
Zn	25	37	46	73	69	48	66	55	67
Zr	22	9.46	9.32	27	91	35	53	185	7.82
<i>REE elements (ppm)</i>									
La	3.11	1.86	2.17	6.86	6.91	5.71	5.21	17	1.01
Ce	7.45	4.44	5.02	17	16	14	13	37	2.4
Pr	1.04	0.64	0.67	2.21	2.14	2.01	1.88	4.81	0.31
Nd	4.85	3.12	3.13	9.57	9.22	9.41	8.97	20.93	1.41
Sm	1.26	0.94	0.82	2.45	2.38	2.54	2.62	5.28	0.35
Eu	0.62	0.52	0.40	0.62	0.60	0.79	0.95	1.78	0.13
Gd	1.28	0.94	0.81	2.26	2.16	2.57	2.78	5.23	0.35
Tb	0.21	0.16	0.13	0.37	0.36	0.44	0.48	0.88	0.06
Dy	1.30	1.06	0.82	2.33	2.21	2.81	3.11	5.79	0.37
Ho	0.27	0.22	0.17	0.47	0.45	0.57	0.65	1.22	0.08
Er	0.70	0.59	0.44	1.20	1.19	1.51	1.67	3.32	0.20
Tm	0.09	0.08	0.06	0.16	0.17	0.21	0.23	0.47	0.03
Yb	0.60	0.56	0.39	1.02	1.07	1.36	1.51	3.13	0.20
Lu	0.09	0.09	0.06	0.15	0.16	0.20	0.23	0.46	0.03
ΣREE	12	8.91	7.91	23	22	24	25	53	3.50

Table S5. Continued.

Rock type Sample n°	Cervino					Tsaté		
	Troctolite	Mesocratic gabbro	Mesocratic gabbro	Mesocratic gabbro	Mesocratic gabbro	Gabbro	Gabbro	Serpentinite
	DBL 232	DBL 2051	DBL 1834	DBL 1821	DBL 1794	36	37	35
SiO ₂	44.26	50.39	47.31	48.67	48.84	46.78	49.31	39.24
Al ₂ O ₃	25.74	18.82	16.53	18.39	17.78	19.01	16.23	2.56
Fe ₂ O ₃	3.72	4.84	6.94	6.58	5.94	4.12	6.31	7.61
MnO	0.07	0.08	0.11	0.08	0.11	0.11	0.10	0.12
MgO	5.85	8.35	10.16	9.50	9.33	8.37	9.06	37.07
CaO	11.57	9.00	12.41	10.75	8.91	16.03	12.37	0.11
Na ₂ O	2.75	4.15	2.06	2.62	3.54	1.72	2.93	bdl
K ₂ O	0.98	0.38	0.20	0.38	0.43	0.03	0.08	bdl
TiO ₂	bdl	0.43	0.88	0.68	0.50	0.44	0.66	0.05
P ₂ O ₅	bdl	0.13	0.17	0.16	0.15	bdl	bdl	0.05
PF	3.92	3.21	2.96	1.94	3.33	2.46	2.54	12.05
Total	98.85	99.78	99.73	99.75	98.86	99.06	99.59	98.86
Mg#	0.76	0.77	0.74	0.74	0.76	0.80	0.74	0.91
<i>Trace elements (ppm)</i>								
As	bdl					bdl	bdl	bdl
Ba	577	49	29	67	101	4.36	7.35	2.01
Be	0.20	0.50	0.80	0.50	1.00	bdl	bdl	bdl
Bi	0.07					0.66	bdl	bdl
Cd	0.07					bdl	bdl	bdl
Co	38	29	34	39	34	27	31	92
Cr	15	403	336	147	469	357	198	2329
Cs	0.70					bdl	bdl	0.44
Cu	107	52	80	30	149	bdl	14	5.45
Ga	16	7.00	7.00	7.00	5.00	14	13	2.21
Ge	0.605					1.84	1.51	0.96
Hf	bdl					0.48	0.52	0.04
In	bdl					bdl	bdl	bdl
Mo	1.05					bdl	bdl	bdl
Nb	0.37	bdl	bdl	bdl	bdl	0.23	0.27	bdl
Ni	141	213	74	115	68	169	115	1762
Pb	2.40					1.28	0.78	2.059
Rb	24	13	9	11	13	0.55	1.45	bdl
Sc	bdl	27	42	25	29	43	39	13
Sb	bdl					0.42	0.27	bdl
Sn	bdl					bdl	bdl	bdl
Sr	1222	291	371	390	305	154	255	bdl
Ta	0.50					0.03	0.03	bdl
Th	0.06	bdl	6.00	bdl	5.00	bdl	bdl	bdl
U	0.02					bdl	bdl	bdl
V	4.42	104	171	115	117	141	163	54
W	120					54	26	2.61
Y	0.72	14	19	15	12	10	11	1.28
Zn	40.12	49	173	44	51	30	28	59
Zr	3.346	37	54	39	34	14	15	bdl
<i>REE elements (ppm)</i>								
La	2.02	4.87	6.21	5.22	4.65	0.67	0.53	bdl
Ce	3.80	12	17	14	11	2.17	1.82	bdl
Pr	0.43					0.40	0.37	0.02
Nd	1.60	8.10	12	9.41	7.10	2.31	2.25	0.10
Sm	0.27	2.33	3.59	2.52	1.85	0.96	1.01	0.06
Eu	0.46	0.83	1.18	0.91	0.80	0.52	0.65	0.03
Gd	0.20	1.97	3.42	2.23	1.81	1.35	1.43	0.12
Tb	0.03					0.26	0.26	0.03
Dy	0.15	2.14	3.67	2.34	1.93	1.80	1.88	0.19
Ho	0.03					0.42	0.42	0.05
Er	0.07	1.12	1.94	1.26	1.04	1.11	1.15	0.14
Tm	0.01					0.16	0.17	0.02
Yb	0.06	1.02	1.86	1.21	1.02	1.04	1.08	0.16
Lu	0.01	0.15	0.26	0.17	0.14	0.16	0.16	0.03
ΣREE	3.31	34	51	39	31	13	13	0.95

Table S5. Continued.