Table 1. Location of the collected samples from the 1835 AD Osorno eruption.

Location name	Longitude	Latitude
Os-144	72°31'55" W	41°8'42" S
Os-147	72°32'21" W	41°8'7" S
Os-154	72°34'36" W	41°9'25" S
Os-155	72°36'52" W	41°7'37" S
Os-156	72°34'12" W	41°10'10" S
Os-164	72°32'3" W	41°8'38" S
LV-152	72°19'32" W	41°23'9" S
LV-153	72°19'52" W	41°22'15" S

Table 2. Whole-rock analyses of samples from the 1835 Osorno (Os) eruption and La Viguería (LV) cone.

	Detection limit	Os-144a	Os-147a	Os-154a	Os-164a	LV-152a	LV-153a
		Lava	Lava	Lava	Lapilli	Lava	Bomb
wt. %							
SiO_2	0.01	52.4	52.9	52.7	52.9	51.3	52.3
Al_2O_3	0.01	20.1	19.7	20.7	19.6	17.8	17.9
TiO_2	0.01	0.9	0.9	0.9	0.9	0.9	0.9
FeO	0.2	6.3	5.5	5.6	5.6	5.5	5.9
Fe_2O_3	0.01	1.47	2.66	2.04	2.62	3.17	2.29
MnO	0.01	0.14	0.14	0.15	0.16	0.16	0.16
MgO	0.01	4.47	4.21	4.09	4.55	7.97	7.05
CaO	0.01	10.6	10.2	10.9	10.2	9.81	10.1
Na_2O	0.01	3.01	3.14	3.06	3.05	2.75	2.91
K_2O	0.01	0.49	0.51	0.48	0.48	0.63	0.69
P_2O_5	0.01	0.13	0.13	0.13	0.13	0.2	0.2
LOI		-0.5	-0.4	-0.4	-0.4	-0.1	-0.3
TOTAL		100	100	100.8	100.2	100.2	100.4
$\mu g \cdot g^{-1}$							
Li	0.1	9.9	10.5	10.6	9.7	7.2	6.4
Sc	0.1	31	30	30	31	32	32
V	0.1	256	252	249	248	237	242
Co	0.1	39.8	38	36.3	49.9	55.6	43.4
Ni	0.1	34	26	28	24	101	65
Cu	0.5	93.5	87.9	92.7	74.3	84.5	80.4
Cr	0.1	79.7	60.1	77.7	67.6	218	167
Zn	2	77	81	73	75	72	71
Tl	0.05	0.07	0.06	0.05	0.06	0.07	0.07
Rb	0.1	13.8	13.8	12.9	12.5	8.8	10.2
Ba	1	141	141	135	129	162	181
Th	0.1	1	1	0.9	0.9	1.3	1.4
U	0.1	0.3	0.3	0.3	0.3	0.4	0.4
Nb	0.1	2	1.9	1.9	3	7.9	2.9
La	0.1	5.7	5.5	5.4	5.3	9.7	9.7
Ce	1	15	14	14	14	24	24
Pb	0.1	5.6	5.5	5.2	5.9	6.3	5.8
Pr	0.1	2	2	1.9	1.9	3.1	3.1
Sr	1	412	386	410	376	575	614
Nd	0.1	9.9	9.6	9.4	9.3	14.5	14.4
Zr	0.1	65.3	64.4	61.7	59.5	81.9	82.6
Sm	0.1	2.7	2.7	2.6	2.6	3.5	3.5
Eu	0.1	0.9	0.9	0.9	0.9	1.1	1.1
Gd	0.1	3	2.9	2.8	2.8	3.4	3.4
Tb	0.1	0.5	0.5	0.5	0.5	0.5	0.5
Dy	0.1	3.1	3	2.9	2.9	3.2	3.2
Ho	0.1	0.7	0.7	0.6	0.6	0.7	0.7
Er	0.1	1.9	1.9	1.8	1.8	1.9	1.9
Y	0.1	19.3	19.2	18.5	18.5	19.4	20.3
Yb	0.1	1.9	1.8	1.8	1.9	1.8	1.9
Lu	0.1	0.3	0.3	0.3	0.3	0.3	0.3

Table 3. Isotopic data of the volcanic material of the zone.

Sample	$^{87}Sr/^{86}Sr$	± 2 σ	$^{143}Nd/^{144}Nd$	± 2 σ
1835 Osorno products (this study)				
Os-144	0.704333	5	0.512741	12
Os-147	0.704309	4	0.512784	4
Os-154	0.704324	6	0.512766	7
Os-164	0.704310	5	0.512774	4
Other Osorno products (Jacques et al., 2014)				
CL-098	0.704300	2	0.512806	3
CL-102	0.704335	3	0.512796	3
Other Osorno products (Tagiri et al., 1993)				
OS-04	0.704410	50	-	-
OS-18	0.704470	50	-	-
OS-17	0.704450	50	-	-
OS-14	0.704460	50	-	-
OS-15	0.704330	50	-	-
OS-16	0.704340	50	-	-
OS-02	0.704350	50	-	-
OS-01	0.704410	50	-	-
OS-07	0.704370	50	-	-
OS-03	0.704330	50	-	-
OS-06	0.704440	50	-	-
OS-05	0.704450	50	-	-
OS-09	0.704510	50	-	-
2015 Calbuco products (this study)				
Cal-149a	0.704413	4	0.512685	5
Cal-149b	0.704406	8	0.512680	5
Cal-157	0.704398	5	0.512803	15
Cal-158	0.704384	8	0.512835	15
Cal-159	0.704413	5	0.512770	5
Cal-160	0.704438	8	0.512796	4
Other Calbuco products (López-Escobar et al., 1995b)				
3282-2 (Unit 3)	0.704369	30	0.512774	18
3282-4 (Unit 3)	0.704644	30	0.512727	18
3282-5 (Unit 4)	0.704551	30	0.512744	18
La Viguería products (this study)				
LV-152	0.703705	6	0.512829	3
LV-153	0.703753	6	0.512763	6

Table 3. (continued)

Sample	$^{87}Sr/^{86}Sr$	± 2 σ	$^{143}Nd/^{144}Nd$	± 2 σ
Cayutué-LaViguería volcanic field products (López-Escobar et al., 1995b)				
21282-1 (Cayutué)	0.703720	3	0.512840	18
PC-132 (Cayutué)	0.703686	3	0.512828	18
4476- lb (La Viguería)	0.703700	3	0.512852	18
AC-86-2 (La Viguería)	0.703689	3	0.512747	18
VC-42-2 (Pocoihuen)	0.703912	3	0.512796	18
PC-127-2 (Cabeza de Vaca)	0.703763	3	0.512788	18
North Patagonian Batholith, gabbro (Aragón et al., 2011)				
ANG2010-3	0.703550	-	0.512920	-
North Patagonian Batholith, granodiorite (Aragón et al., 2011)				
ANG2010-4	0.703770	-	0.512870	-
Granulite xenoliths (Hickey-Vargas et al., 1995)				
3282-2f	0.704010	3	0.513170	18
21-4	0.704210	3	0.513149	18
Gabbro xenolith (Hickey-Vargas et al., 1995)				
19-18	0.704580	3	0.512707	18
Altered oceanic crust (Jacques et al., 2014)				
AOC	0.704769	-	0.513153	-
Trench sediments from CSVZ (Kilian and Behrmann, 2003)				
859	0.70817	15	0.51245	6
860B	0.71195	15	0.51232	6
861C	0.70605	15	0.51261	6
863A	0.70614	15	0.51263	6
863B	0.70619	15	0.51264	6
Chapo Granitoids (Munizaga et al., 1988)				
CHAPO-2A	0.705010	70	-	-
CHAPO-3A	0.705580	70	-	-
CHAPO-3B	0.708890	70	-	-
CHAPO-3C	0.70680	70	-	-
CHAPO-3D	0.706210	70	-	-
CHAPO-4A	0.704830	70	-	-
CHAPO-4B	0.704770	70	-	-
CHAPO-4C	0.705040	70	-	-
Enriched mantle (Garapić et al., 2015)				
PIT-8	0.704633	45	0.512538	40
Depleted- MORB mantle (Workman and Hart., 2005)				
DMM	0.702630	-	0.513130	-

Table 4. Analytical conditions of electron microprobe measurements.

Phase	Major/trace	Elements	Acceleration potential (keV)	Current (nA)	Counting times (s)*
Plagioclase**	Major	Si, Al, Ca, Na, K	20	10	40
	Trace	Ti, Fe, Ba	20	40	240
	Trace	Mg, Sr	20	40	480
Olivine	Major	Si, Mg, Fe	20	30	60
	Trace	Ni, Cr, Mn	20	100	120
	Trace	Ca	20	100	280
	Trace	Ti, Al	20	100	160
Pyroxene	Major	Si, Mg, Fe, Ca	20	30	60
	Trace	Ni, Na, Al, Ti	20	80	120
	Trace	Cr, Mn	20	80	160
Spinel	Major	Al, Fe, Mg, Cr, Ti, O	15	50	240
	Trace	Ca, Ni, Co, Mn, Si, V	15	50	120
Fe-Ti oxides	Major	Ti, Fe	15	30	80
	Major	O	15	30	260
	Trace	Si, Mn, Nb, Mg, Cr, Ca, Zn, Co	15	30	60
	Trace	V, Mg, Al, Ni, Zn, Co	15	30	80
Glass**	Major	Si, Al, Na	15	10	30
	Major	Ti, Mn, Mg, P	15	10	80
	Major	Fe, Ca	15	10	40
	Major	K	15	10	20
	Trace	Cr	15	10	60
	Trace	Si, Al, Na	15	10	120

* Counting time was distributed equally between on-peak and background measurements.

** Indicating phases where elements were measured using defocused beam (up to 5 µm).

Table 5. Main features of the collected samples from the 1835 eruption of Osorno Volcano (Os) and La Viguería cone (LV).

Section name	Description	Vesicles (%)	Groundmass (%)	Plagioclase (%)	Olivine (%)	Pyroxene (%)	Crystallinity (%)*	Eruptive stage
Os-144a	LF	15.3	48.5	33.1	2.5	0.6	42.7	2
Os-144b	LF	15.7	46.5	34.7	2.3	0.8	44.8	2
Os-147a	LF	14.7	65.1	19.8	0.3	0.1	23.7	1
Os-147b	LF	16.9	60.8	21.7	0.5	0.1	26.8	1
Os-154a	LF	7.7	60.4	30.9	0.9	0.1	34.6	1
Os-154b	LF	7.8	58.1	32.6	1.3	0.2	37	1
Os-155a	LF	4.4	69.3	25.9	0.3	0.1	27.5	2
Os-155b	LF	7.4	64.6	27.5	0.4	0.1	30.2	2
Os-156a	LF	13.2	51.8	33.1	1.5	0.4	40.3	1
Os-156b	LF	9.7	55.3	32.8	2.1	0.1	38.8	1
Os-164a	FD	31.2	43.8	23.4	1.6	0	36.3	2
Os-164b	FD	61.2	28.9	9.3	0.6	0	25.5	2
LV-152	FD	43.3	55.4	0	1	0.3	0.02	-
LV-153	LF	12.2	84.3	0.3	1.8	1.4	0.04	-

LF: Sample collected from a lava flow; FD: Fall deposit (lapilli)

* Percentage not considering vesicles

Table 6. Main features of the mineral phases from samples of 1835 AD Osorno eruption.

Mineral phase	Classification	Size (mm)	Morphology	Textures
Plagioclase	Phenocryst	0.2-2	Euhedral*	Patchy zoning, sieve, and partial resorption*
	Microphenocryst	0.09-0.2	Euhedral to subhedral	No zoning patterns
	Microlite	< 0.09	Euhedral to subhedral	Trachytic (flow) and no zoning patterns
Olivine	Phenocryst	0.2-0.7	Euhedral to subhedral**	Some crystals show embayments**
	Microphenocryst	0.01-0.2	Euhedral	-
	Microlite	< 0.01	Euhedral to subhedral	-
Clinopyroxene	Phenocryst	0.15-0.4	Euhedral to subhedral	-
	Inclusions	0.03-0.15	Subhedral	Inclusions in olivine
Spinel	Inclusions	0.01-0.04	Euhedral	Inclusions in olivine
	Microphenocryst	0.01-0.04	Euhedral to subhedral	-

* Example in Figure 4.

** Example in Figure 5.

Table 7. Representative compositions (wt. %) of olivine-hosted melt inclusions (M.I.), interstitial glass*, and glass from Osorno volcanic products, measured by EPMA.

Sample	F12_2_1	F23_1_4	F28_1_10	F47_1_7	F9_1_6	F45_1_12	F20_1_6	F25_1_8	F4_1A	F1_1B	F10_g1	F13_g1a
Melt	M.I.	M.I.	M.I.	M.I.	M.I.	M.I.	M.I.	M.I.	Interstitial	Interstitial	Glass	Glass
SiO_2	52.86	54.18	53.25	52.88	53.36	53.06	52.93	52.78	52.3	52.4	54.5	56.3
TiO_2	1.05	1.1	1.11	1.08	1.05	1.13	1.02	1	1	1	1.1	1.5
Al_2O_3	16.35	15.86	16.92	16.4	16.89	16.95	15.93	16.37	16.6	16.5	15.8	13.8
Cr_2O_3	0.04	0.04	0	0.06	0	0	0.03	0	0	0	0	0
FeOtot	8.87	9	9.7	9.43	9.26	9.74	9.38	8.98	9.5	9.4	9.3	11.1
MnO	0.17	0.15	0.16	0.2	0.17	0.23	0.19	0.13	0.2	0.1	0.2	0.2
MgO	5.13	4.91	4.59	5.34	4.85	4.5	5.31	5.33	5	5	5.6	4
CaO	8.26	8.23	8.67	8.45	8.93	9.21	8.53	8.72	8.9	8.7	8.2	7.9
Na_2O	3.86	3.74	3.46	3.34	3.27	3.24	3.08	2.8	2.9	2.8	3.2	3.4
K_2O	0.54	0.72	0.58	0.58	0.54	0.67	0.57	0.56	0.5	0.5	0.6	0.9
P_2O_5	0.14	0.16	0.15	0.16	0.15	0.18	0.13	0.15	0.1	0.1	0.2	0.2
SO_3	0.16	0.15	0.1	0.17	0.13	0.13	0.18	0.16	0.1	0.2	0.2	0.2
TOTAL	97.43	98.24	98.69	98.09	98.6	99.04	97.28	96.98	97.2	96.8	98.7	99.4
Fo	0.782	0.779	0.716	0.780	0.786	0.717	0.781	0.780	—	—	—	—

* Interstitial glass corresponds to melt that was in between crystal from clots of crystals.

Table 8. Anhydrous chemical composition (wt. %) of the groundmass of a representative sample (Os-144) of the 1835 AD Osorno eruption (Unit 4) and aphyric samples from the Unit 3 (for comparison).

Name	Os-144*	OS-14**	OS-15**
Composition	Groundmass	Aphyric	Aphyric
Unit	4	3	3
SiO_2	55.41	54.41	54.49
TiO_2	1.53	1.53	1.53
Al_2O_3	13.37	16.84	17.21
FeOtot	11.64	10.02	9.72
MnO	0.23	0.18	0.19
MgO	5.33	3.7	3.81
CaO	7.76	7.75	7.72
Na_2O	3.39	3.63	3.74
K_2O	0.81	0.87	0.88
P_2O_5	0.23	-	-
TOTAL***	99.7	98.93	99.29
FeO	9.34	7.11	6.83
Fe_2O_3	2.56	3.23	3.21

* Values obtained via extraction of composition of modal mineralogy to whole rock chemistry of the sample Os-144 (Table 3).

** Values reported in Tagiri et al. (1993).

*** Total is less than 100% in Os-144 composition, because SrO and BaO values were omitted.

Table 9. Size, temperature and associated timescales of post entrapment crystallisation in olivine-hosted melt inclusions.

Melt inclusion	Radius (µm)	T (°C)	Timescale (s)	T(°C)	Timescale (s)
MI_Fig12_2_14	136	850	1140	1060	29
MI_Fig23_1_1	64	850	1520	1060	38
MI_Fig28_1_1	135	850	1460	1060	36
MI_Fig47_1_1	114	850	1955	1060	49
MI_Fig9_1_1	93	850	690	1060	17
MI_Fig25_1	122	850	1185	1060	29

Table 10. Calculated intensive physical conditions, methods, and associated uncertainties of the Osorno volcano samples.

Related to olivine Group 1

Phases	Physical intensive condition	Reference	Range	Average	Standard deviation	Uncertainty
Olivine-augite	Temperature (ºC)	Loucks (1996)	1131-1140	1135	4	15
Ca in olivine	Temperature (ºC)	Shejwalkar and Coogan (2013)	1094-1097	1096	2	22
Olivine-spinel	Temperature (ºC)	Coogan et al. (2014)	1051-1070	1061	6	42
Olivine-spinel	Oxygen fugacity buffer (ΔQFM)	Ballhaus et al. (1991)	-	2.3	-	0.7
Spinel-melt	Oxygen fugacity buffer (ΔQFM)	Borisov et al. (2018)	1.1-1.2	1.1	-	0.5
Spinel-melt	Oxygen fugacity buffer (ΔQFM)	Jayasuriya et al. (2004)	0.6-0.7	0.7	-	0.3
Olivine-melt	Water dissolved (wt. %)	Gavrilenko et al. (2016)	3.4-4.8	4.3	0.5	0.8

Related to olivine Group 2

Phases	Physical intensive condition	Reference	Range	Average	Standard deviation	Uncertainty
Olivine-augite	Temperature (ºC)	Loucks (1996)	1118-1170	1140	17	15
Ca in olivine	Temperature (ºC)	Shejwalkar and Coogan (2013)	1049-1173	1129	40	22
Olivine-spinel	Temperature (ºC)	Coogan et al. (2014)	1104-1122	1113	13	42
Olivine-spinel	Oxygen fugacity buffer (ΔQFM)	Ballhaus et al. (1991)	-	2.7	-	0.7
Spinel-melt	Oxygen fugacity buffer (ΔQFM)	Borisov et al. (2018)	1.3-1.4	1.4	-	1
Spinel-melt	Oxygen fugacity buffer (ΔQFM)	Jayasuriya et al. (2004)	1.4	1.4	-	0.3
Olivine-melt	Water dissolved (wt. %)	Gavrilenko et al. (2016)	3.4-5	4.2	1.1	0.8
Melt	Water dissolved (wt. %)	Kelley and Cottrell (2009)	5.6	-	-	1.2