

Appendix 1. Anomalously high element concentrations and specific isotopic compositions associated by source. Peak values are shown in brackets. See Figure 2 for the sampling site number location. (*T): Tributary of a main river or stream in the area. Source is from geological maps (SERNAGEOMIN, AAPlc exploration and mining geological maps) and field observation during sampling for all sites of the river stream float and basin talus. For the agricultural areas, N isotopes have been used to identify the source as fertiliser, sewage and mixture of nitrate sources and sulphur isotopes to identify sulphur and sulphate sources.

Sample Site N°	Area ID	pH	TDS mg/l	Anomalous chemistry and isotopic composition	Source
Colorado River, 203 km²					
1	Colorado River	7.7	334	Cd (0.8 µg/l), Ni (5.6 µg/l), δ ³⁴ S (3.5‰), δ ¹⁸ O _{SO4} (-3.4‰)	Hydrothermal Alteration
2	Blanco River (*T)	5.9	407	Cd (3.3 µg/l), Fe (6 mg/l), Ni (14.5 µg/l), Zn (175 µg/l), δ ³⁴ S (-0.6‰), δ ¹⁸ O _{SO4} (8.3‰)	Hydrothermal Alteration
3	Colorado River	7.4	355	Cd (1.4 µg/l), Hg (3.4 µg/l), Ni (11 µg/l)	Hydrothermal Alteration
4	Colorado River	7.5	336	Ni (7.3 µg/l), δ ³⁴ S (2.1‰), δ ¹⁸ O _{SO4} (1.2‰)	Hydrothermal Alteration
Riebillos River, 11 km²					
5	Agua Mala (*T)	7.2	86	As (65.9 µg/l), Mo (8.1 µg/l), δ ³⁴ S (0.5‰), δ ¹⁸ O _{SO4} (-1‰)	Hydrothermal Alteration
6	Riebillos River	7.7	198	As (11.3 µg/l), δ ³⁴ S (5.9‰), δ ¹⁸ O _{SO4} (0.5‰)	Hydrothermal Alteration
Arrayán and San Francisco rivers, 55 km²					
7	Ortiga (*T)	4.8	106	Al (0.3 mg/l), F ⁻ (480 µg/l), δ ³⁴ S (2.8‰), δ ¹⁸ O _{SO4} (3‰)	Hydrothermal Alteration
8	Del Rayo (*T)	3.2	206	Al (4 mg/l), F ⁻ (838 µg/l), Fe (5 mg/l), Ni (21 µg/l), Zn (40 µg/l), δ ³⁴ S (-3.8‰), δ ¹⁸ O _{SO4} (-7.7‰)	Hydrothermal Alteration
9	Ortiga (*T)	3.4	334	Al (6 mg/l), F ⁻ (380 µg/l), Fe (5 mg/l), Hg (3.1 µg/l), Ni (33 µg/l), Zn (83 µg/l), δ ³⁴ S (-3.8‰), δ ¹⁸ O _{SO4} (-4.5‰)	Hydrothermal Alteration
10	Valle Largo (*T)	4.7	437	Al (5 mg/l), F ⁻ (504 µg/l), Fe (0.8 mg/l), Ni (28 µg/l), SO ₄ ²⁻ (357 mg/l), Zn (31 µg/l), δ ³⁴ S (-0.7‰), δ ¹⁸ O _{SO4} (4.5‰), δ ¹⁵ N (2‰), δ ¹⁸ O _{NO3} (34‰)	Hydrothermal Alteration
11	El Plomo (*T)	6.8	137	Ni (6.5 µg/l), Zn (102 µg/l), δ ³⁴ S (-2‰), δ ¹⁸ O _{SO4} (-4.8‰)	Hydrothermal Alteration
12	Duarte (*T)	8	204	Mo (9.3 µg/l), P (68 µg/l), δ ³⁴ S (4.3‰), δ ¹⁸ O _{SO4} (-2.9‰)	Hydrothermal Alteration
Tupungato and Maipo Volcanoes, 110 km²					
13	Rabícano (*T)	7.9	595	SO ₄ ²⁻ (354 mg/l), Zn (71 µg/l)	Hydrothermal Alteration
14	Las Amarillas (*T)	7.9	1076	Ca (294 mg/l), Mg (29 mg/l), Ni (16 µg/l), SO ₄ ²⁻ (953 mg/l), δ ³⁴ S (0.3‰), δ ¹⁸ O _{SO4} (-4.1‰)	Hydrothermal Alteration
15	Barroso River	7.1	1352	As (17 µg/l), Fe (3043 µg/l), Mg (38 mg/l), Ni (40 µg/l), δ ³⁴ S (10.2‰), δ ¹⁸ O _{SO4} (-2.1‰)	Hydrothermal Alteration
Colorado River, 8 km²					
16	Torin (*T)	2.8	506	Al (12 mg/l), Cd (1.3 µg/l), Cu (457 µg/l), Fe (8 mg/l), Ni (19 µg/l), Pb (1.4 µg/l), SO ₄ ²⁻ (368 mg/l), Zn (219 µg/l), δ ³⁴ S (4.3‰), δ ¹⁸ O _{SO4} (-1.8‰)	Cu-mineralized areas
Barriga River, 17 km²					
17	Barriga River	5.4	905	Al (8 mg/l), Ca (215 mg/l), Cd (0.89 µg/l), Cu, (120 µg/l), F ⁻ (650 µg/l), Fe (1 mg/l), Hg (1.3 µg/l), Mg (26 mg/l), Ni (59.1 µg/l), SO ₄ ²⁻ (968 mg/l), Zn (265 µg/l), EC (1136 µS/cm), δ ³⁴ S (-0.2‰), δ ¹⁸ O _{SO4} (-4.5‰), δ ¹⁵ N (0.0‰), δ ¹⁸ O _{NO3} (34.8‰)	Cu-mineralized areas
San Francisco River, 12 km²					

18	Dolores (*T)	6.3	326	Cd (0.79 µg/l), Cu (258 µg/l), Fe (0.7 mg/l), Ni (6.5 µg/l), Zn (345 µg/l), $\delta^{34}\text{S}$ (4.3‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (-2.5‰)	Cu-mineralized areas
19	San Francisco	6.6	277	Cu (803 µg/l), Ni (12 µg/l), Zn (131 µg/l), $\delta^{34}\text{S}$ (2.9‰), $\delta^{15}\text{N}$ (0.3‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (38‰)	Cu-mineralized areas
Yerba Loca Stream, 155 km²					
20	Yerba Loca headwaters	2.0	1070	Al (6 mg/l), As (14 µg/l), Cu (11693 µg/l), Fe (45 mg/l), Ni (26 µg/l), P (694 µg/l), SO_4^{2-} (446 mg/l), Zn (124 µg/l), $\delta^{34}\text{S}$ (4.2‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (-0.4‰)	Cu-mineralized areas
21	Yerba Loca	5.7	262	Al (0.2 mg/l), Cu (3275 µg/l), Ni (18 µg/l), Zn (173 µg/l), $\delta^{34}\text{S}$ (3.2‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (-0.4‰), $\delta^{15}\text{N}$ (-1.5‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (39.4‰)	Cu-mineralized areas
22	Yerba Loca	5.1	310	Al (1 mg/l), Cu (4185 µg/l), Ni (18 µg/l), Zn (175 µg/l), $\delta^{34}\text{S}$ (2.9‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (-0.4‰)	Cu-mineralized areas
Fertilizers, 270 km²					
23	Carretón (*T)	7.5	353	HCO_3^- (152 mg/l), Mg (24 mg/l), NO_3^- (4 mg/l), P (89 µg/l), $\delta^{34}\text{S}$ (4.9‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (3.8‰), $\delta^{15}\text{N}$ (3.5‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (19.2‰)	Agricultural areas
24	El Melón Stream	7.1	440	HCO_3^- (161 mg/l), Mg (23 mg/l), NO_3^- (14 mg/l), P (105 µg/l), $\delta^{34}\text{S}$ (4.4‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (3.2‰), $\delta^{15}\text{N}$ (5.3‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (16.2‰)	Agricultural areas
25	Aconcagua River	8.4	361	NO_3^- (6 mg/l), $\delta^{34}\text{S}$ (5.7‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (19.8‰), $\delta^{15}\text{N}$ (6.2‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (16.9‰)	Agricultural areas
26	Catemu (*T)	6.9	422	HCO_3^- (174 mg/l), Mg (20 mg/l), NO_3^- (20 mg/l), P (105 µg/l), $\delta^{34}\text{S}$ (5.9‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (3.8‰), $\delta^{15}\text{N}$ (2.8‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (9.5‰)	Agricultural areas
27	Los Loros (*T)	7.1	497	HCO_3^- (195 mg/l), NO_3^- (15 mg/l), $\delta^{34}\text{S}$ (3.5‰), $\delta^{15}\text{N}$ (4.9‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (15.9‰)	Agricultural areas
28	Ocoa (*T)	8.5	519	HCO_3^- (199 mg/l), Mg (24 mg/l), NO_3^- (14 mg/l), P (155 µg/l), Pb (0.9 µg/l), $\delta^{34}\text{S}$ (5.1‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (2.5‰), $\delta^{15}\text{N}$ (4.3‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (14.9‰)	Agricultural areas, human settlements
29	Colina Stream	8.1	320	HCO_3^- (154 mg/l), NO_3^- (29 mg/l), $\delta^{34}\text{S}$ (3‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (12.5‰), $\delta^{15}\text{N}$ (3.7‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (7.8‰)	Agricultural areas
30	Mapocho River	7.9	932	Ca (164 mg/l), Cl (144 mg/l), HCO_3^- (191 mg/l), Hg (1.6 µg/l), K (8 mg/l), Mg (24 mg/l), Na (85 mg/l), NO_3^- (34 mg/l), P (1613 µg/l), SO_4^{2-} (374 mg/l), $\delta^{34}\text{S}$ (11‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (27.2‰), $\delta^{15}\text{N}$ (4.7‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (14.3‰)	Agricultural areas, human settlements, evaporites
Sewage, 160 km²					
31	Aconcagua River	8.5	349	NO_3^- (4 mg/l), $\delta^{34}\text{S}$ (4.8‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (2.3‰), $\delta^{15}\text{N}$ (11.9‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (29.5‰)	Agricultural areas
32	Mapocho River	7.4	1180	Ca (141 mg/l), Cl (209 mg/l), F ⁻ (390 µg/l), HCO_3^- (220 mg/l), K (17 mg/l), Mo (8.6 µg/l), Na (146 mg/l), NO_3^- (5 mg/l), P (9021 µg/l), $\delta^{34}\text{S}$ (12.7‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (8.3‰), $\delta^{15}\text{N}$ (10.1‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (21‰)	Agricultural areas, evaporates
Mixed nitrate sources, 280 km²					
33	La Ligua River	8.4	262	K (5.2 mg/l), NO_3^- (4 mg/l), P (664 µg/l), $\delta^{34}\text{S}$ (3.4‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (10.2‰), $\delta^{15}\text{N}$ (4.8‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (31.3‰)	Agricultural areas
34	El Melón Stream	6.6	563	HCO_3^- (158 mg/l), Mg (36 mg/l), NO_3^- (11 mg/l), P (495 µg/l), $\delta^{34}\text{S}$ (3.2‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (5.5‰), $\delta^{15}\text{N}$ (8.1‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (30.9‰)	Agricultural areas
35	Aconcagua River	8.1	404	HCO_3^- (154 mg/l), NO_3^- (12 mg/l), $\delta^{34}\text{S}$ (4.5‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (3‰), $\delta^{15}\text{N}$ (7.2‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (12‰)	Agricultural areas
36	El Arrayán Stream	7.7	287	NO_3^- (9 mg/l), $\delta^{34}\text{S}$ (0.4‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (6.2‰), $\delta^{15}\text{N}$ (6.9‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (21.5‰)	Agricultural areas
37	Picarquín (*T)	7.3	351	NO_3^- (12 mg/l), P (68 µg/l), Pb (2.8 µg/l), $\delta^{34}\text{S}$ (5.8‰), $\delta^{18}\text{O}_{\text{SO}_4}$ (7.1‰), $\delta^{15}\text{N}$ (8.1‰), $\delta^{18}\text{O}_{\text{NO}_3}$ (25.8‰)	Agricultural areas, human settlements

38	Maipo River	8.5	854	Ca (152 mg/l), Cl (128 mg/l), K (6 mg/l), Na (79 mg/l), NO ₃ ⁻ (5 mg/l), P (98 µg/l), SO ₄ ²⁻ (401 mg/l), δ ³⁴ S (11‰), δ ¹⁸ O _{SO4} (10.1‰), δ ¹⁵ N (8.8‰), δ ¹⁸ O _{NO3} (29.9‰)	Agricultural areas
Human settlements, 93 km²					
39	Colina Stream	8.2	211	As (14.8 µg/l), Pb (4 µg/l)	Human settlements
40	Maipo River	8.0	672	Ca (122 mg/l), Cl (99 mg/l), Na (66 mg/l), Pb (3.5 µg/l), SO ₄ ²⁻ (377 mg/l)	Human settlements, evaporites
41	Manzanito (*T)	7.6	115	Al (0.7 mg/l), Fe (697 µg/l), P (185 µg/l)	Human settlements
Blanco River, 10 km²					
42	Andina mine	7.7	264	Mo (17 µg/l), δ ³⁴ S (2.3‰), δ ¹⁸ O _{SO4} (-3.0‰)	Mine area waters
San Francisco River, 24 km²					
43	Los Bronces mine	7.9	468	Cd (0.89 µg/l), Cl (82 mg/l), Na (51 mg/l), Zn (91.3 µg/l), δ ³⁴ S (2.2‰), δ ¹⁸ O _{SO4} (-2.4‰), δ ¹⁵ N (1.1‰), δ ¹⁸ O _{NO3} (37.5‰)	Mine area waters
El Gallo Stream, 0.2 km²					
44	El Soldado mine	8.4	672	Fe (178 µg/l), Mg (34 mg/l), Mo (12 µg/l), SO ₄ ²⁻ (324 mg/l), δ ³⁴ S (3.7‰), δ ¹⁸ O _{SO4} (0.7‰)	Mine area waters
La Poza Stream, 20 km²					
45	La Poza and Restauradora mines	7.1	324	HCO ₃ ⁻ (178 mg/l), Pb (1.1 µg/l), Zn (87 µg/l), δ ³⁴ S (-1.1‰), δ ¹⁸ O _{SO4} (-0.4‰)	Mine area waters