**Comparison of soil characteristics from geophysical and geochemical techniques along a
climate and ecological gradient, Chilean Coastal Cordillera (26° to 38° S)**

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Fig. S1: Compilation of physical and chemical investigations with depth at the pedon location in the mid-slope position of the S-facing hillslope in Pan de Azúcar. Properties shown are: 1) GPR transect and the envelope profile of the 500 MHz measurement; 2) GPR transect and the envelope profile of the 1000 MHz measurement; 3) Bulk density; 4) Grain size distribution of sand, silt, and clay; 5) Loss on ignition LOI; 6) Chemical index of alteration CIA; 7) Chemical index of the mass transfer coefficient Tau τ ; and 8) volumetric strain ϵ_{strain} . The black line indicates the boundary between the mobile soil and the immobile saprolite (after Oeser et al., 2018) and the gray area with green lines reflects the transition zone from B to C horizon (after Bernhard et al., 2018).

Fig. S2: Compilation of physical and chemical investigations at the pedon location in the toe-slope position of the S-facing hillslope in Pan de Azúcar.

Fig. S3: Compilation of physical and chemical investigations at the pedon location in the mid-slope position of the N-facing hillslope in Pan de Azúcar.

Fig. S4: Compilation of physical and chemical investigations at the pedon location in the top-slope position of the S-facing hillslope in Santa Gracia.

Fig. S5: Compilation of physical and chemical investigations at the pedon location in the toe-slope position of the S-facing hillslope in Santa Gracia.

Fig. S6: Compilation of physical and chemical investigations at the pedon location in the mid-slope position of the N-facing hillslope in Santa Gracia.

Fig. S7: Compilation of physical and chemical investigations at the pedon location in the top-slope position of the S-facing hillslope in La Campana.

Fig. S8: Compilation of physical and chemical investigations at the pedon location in the toe-slope position of the S-facing hillslope in La Campana.

Fig. S9: Compilation of physical and chemical investigations at the pedon location in the mid-slope position of the N-facing hillslope in La Campana.

Fig. S10: Compilation of physical and chemical investigations at the pedon location in the top-slope position of the S-facing hillslope in Nahuelbuta.

Fig. S11: Compilation of physical and chemical investigations at the pedon location in the toe-slope position of the S-facing hillslope in Nahuelbuta .

Fig. S12: Compilation of physical and chemical investigations at the pedon location in the mid-slope position of the N-facing hillslope in Nahuelbuta.

Fig. S13: Primary component analysis PCA of parameters for all soil pedons in all four Earth Shape areas. A) Scree plot showing the percentage of explained variances and B) Variables - PCA.

Fig. S14: 1000 MHz GPR transect and envelope profile for the mid-slope position of the N-facing hillslope in Pan de Azúcar (AZPED21). The hillslope transect spans over ~13 m. Interpretation of the radar signal are indicated where possible (stippled and black lines in A and B). The potential soil thickness is indicated based on the envelopes (stars). Uphill is from left to right.

Fig. S15: 1000 MHz GPR transect and envelope profile for the top-slope position of the S-facing hillslope in Santa Gracia (SGPED20). The hillslope transect spans over ~13 m. The potential soil thickness is indicated based on the envelopes (stars). Uphill is from left to right.

Fig. 16: 1000 MHz GPR transect and envelope profile for the toe-slope position of the S-facing hillslope in Santa Gracia (SGPED60). The hillslope transect spans over ~20 m. The potential soil thickness is indicated based on the envelopes (stars). Uphill is from left to right.

Fig. S17: 1000 MHz GPR transect and envelope profile for the top-slope position of the N-facing hillslope in Santa Gracia (SGPED70). The hillslope transect spans over ~16 m. The potential soil thickness is indicated based on the envelopes (stars). Uphill is from left to right.

Fig. S18: 500 MHz GPR transect and envelope profile for the top-slope position of the S-facing hillslope in La Campana (LCPED10). The hillslope transect spans over ~20 m. The potential soil thickness is indicated based on the envelopes (stars). Uphill is from left to right.

Fig. S19: 500 MHz GPR transect and envelope profile for the toe-slope position of the S-facing hillslope in La Campana (LCPED30). The hillslope transect spans over ~8 m. The potential soil thickness is indicated based on the envelopes (stars). Uphill is from left to right.

Fig. S20: 500 MHz GPR transect and envelope profile for the mid-slope position of the N-facing hillslope in La Campana (LCPED40). The hillslope transect spans over ~20 m. The potential soil thickness is indicated based on the envelopes (stars). Uphill is from left to right.

Fig. S21: 500 MHz GPR transect and envelope profile for the top-slope position of the S-facing hillslope in Nahuelbuta (NAPED10). The hillslope transect spans over ~6 m. The potential soil thickness is indicated based on the envelopes (stars). Uphill is from left to right.

Fig. 22: 500 MHz GPR transect and envelope profile for the toe-slope position of the S-facing hillslope in Nahuelbuta (NAPED30). The hillslope transect spans over ~7 m. The potential soil thickness is indicated based on the envelopes (stars). Uphill is from left to right.

Fig. 23: 500 MHz GPR transect and envelope profile for the mid-slope position of the N-facing hillslope in Nahuelbuta (NAPED40). The hillslope transect spans over ~6 m. The potential soil thickness is indicated based on the envelopes (stars). Uphill is from left to right.

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Table S:
TableS1A to D

Table S1A: Data compilation for regolith profiles																						
Soil profile	Location		Altitude	Sample	IGSN	Depth	GPR 500 ⁽¹⁾	GPR 1000 ⁽¹⁾	Bulk	Grain size ⁽³⁾			pH ⁽⁴⁾	CEC ⁽⁵⁾	LOI ⁽⁶⁾	CIA ⁽⁷⁾	Ca	Na	Tau ⁽⁸⁾	Mg	Zr	Vol. strain ⁽⁹⁾
	"S	"W	m			cm	MHz	MHz	density ⁽²⁾	sand	silt	clay		μmolc/g								
Pan de Azucar																						
AZPED60	26.11012	70.54922	343	AZPED60-01-RO	GFRO100TP	2.5	3.93E+11	1.83E+12	1.35	52.8	33.0	14.2	8.08		5.08	49.48	-0.44	-0.56	-0.52	1.26	1.08	-0.23
				AZPED60-02-RO	GFRO100TQ	7.5	2.75E+11	1.51E+12	1.19	56.3	28.2	15.5	8.19		4.84	46.15	0.11	-0.44	-0.23	0.75	0.51	0.00
				AZPED60-03-RO	GFRO100TR	15	6.02E+11	2.69E+13		43.8	32.9	23.2	8.17		6.32	17.93	5.47	-0.45	-0.37	2.63	0.21	
				AZPED60-04-RO	GFRO100TS	30	1.52E+13	3.01E+13		41.2	45.7	13.0	8.04		6.39	24.36	3.03	-0.09	-0.33	1.84	0.15	
				AZPED60-05-RO	GFRO100TT	50	2.21E+13	1.93E+13							4.39	45.31	-0.10	0.00	-0.30	0.06	0.33	
				AZPED60-06-RO	GFRO100TU	70	1.06E+13	1.10E+13							4.18	49.14	-0.13	-0.12	-0.27	0.01	0.22	
				AZPED60-07-RO	GFRO100TW	90	6.22E+12	6.95E+12							3.73	48.70	-0.02	0.01	0.06	0.02	-0.13	
				AZPED60-08-RO	GFRO100TV	110	4.82E+12	4.11E+12							3.88	47.88	0.00	0.00	0.00	0.00	0.00	
AZPED50	26.11027	70.54922	333	AZPED50-01-RO	GFRO100TX	2.5	3.37E+11	1.98E+12	1.19				8.01		4.77	52.51	-0.40	-0.08	-0.07	0.74	0.24	0.10
				AZPED50-02-RO	GFRO100TY	7.5	2.16E+11	1.91E+12	1.59	81.3	11.2	7.5	8.10		4.49	36.98	1.24	0.21	0.18	0.13	-0.13	0.00
				AZPED50-03-RO	GFRO100TZ	15	7.01E+11	3.65E+13							3.22	52.45	-0.44	0.21	0.32	-0.14	-0.07	
				AZPED50-04-RO	GFRO100U0	30	1.60E+13	3.06E+13							3.22	50.77	-0.38	0.19	0.13	-0.23	0.02	
				AZPED50-05-RO	GFRO100U1	50	2.32E+13	1.36E+13							3.96	49.82	-0.16	0.17	0.10	-0.06	-0.08	
				AZPED50-06-RO	GFRO100U2	70	1.47E+13	7.75E+12							3.78	51.78	-0.35	-0.01	-0.03	-0.16	0.03	
				AZPED50-07-RO	GFRO100U3	90	1.38E+13	6.06E+12							4.88	42.91	0.56	-0.09	0.08	0.25	-0.09	
				AZPED50-08-RO	GFRO100U4	110	7.58E+12	5.85E+12							4.03	50.20	-0.19	0.08	0.14	-0.07	-0.01	
				AZPED50-09-RO	GFRO100U5	130	5.32E+12	7.41E+12							4.76	48.55	0.00	0.00	0.00	0.00	0.00	
AZPED40	26.11024	70.54921	326	AZPED40-01-RO	GFRO100BJ	2.5	2.92E+11	1.69E+12	1.14	69.4	21.5	9.1	8.11		6.31	42.31	-0.09	-0.16	-0.11	0.23	0.09	-0.18
				AZPED40-02-RO	GFRO100U6	7.5	2.12E+11	1.63E+12	1.39	63.5	22.7	13.7	8.11		7.00	36.83	0.55	-0.34	0.08	0.38	0.02	0.00
				AZPED40-03-RO	GFRO100U7	15	7.47E+11	3.00E+13		44.4	43.8	11.8	8.24		7.48	25.64	2.06	-0.63	0.12	0.37	-0.13	
				AZPED40-04-RO	GFRO100U8	30	1.81E+13	3.25E+13							4.49	52.63	-0.36	-0.70	0.15	0.10	0.05	
				AZPED40-05-RO	GFRO100U9	50	2.33E+13	1.30E+13							5.20	50.52	-0.41	-0.27	-0.06	-0.14	0.15	
				AZPED40-06-RO	GFRO100UA	70	7.12E+12	6.31E+12							6.00	43.77	-0.11	-0.10	-0.03	-0.18	0.07	
				AZPED40-07-RO	GFRO100UB	90	4.37E+12	5.91E+12							7.88	41.11	0.25	-0.39	0.07	0.16	0.03	
				AZPED40-08-RO	GFRO100UC	110	2.45E+12	5.75E+12							6.48	42.28	0.00	0.00	0.00	0.00	0.00	
AZPED21	26.10936	70.54907	342	AZPED21-01-LMM	GFRO100UD	2.5	2.73E+11	8.47E+11	1.20	68.4	21.6	10.0	8.10		4.49	46.47	6.83	2.50	-0.19	2.30	-0.02	-0.36
				AZPED21-02-LMM	GFRO100UE	7.5	1.73E+11	6.77E+11	1.37	78.7	12.2	9.1	8.12		4.14	47.11	7.36	7.50	-0.10	1.73	-0.15	-0.23
				AZPED21-03-LMM	GFRO100UF	15	4.60E+11	1.80E+13	1.32	70.7	10.9	18.4	8.09		3.05	49.19	6.01	15.00	-0.18	1.34	-0.05	0.00
				AZPED21-04-LMM	GFRO100UG	30	1.01E+13	2.16E+13		53.6	27.9	18.5	7.96		4.88	40.57	11.24	30.00	-0.27	1.12	0.10	
				AZPED21-05-LMM	GFRO100UH	50	1.67E+13	2.19E+13							3.06	57.30	1.53	50.00	-0.20	0.51	-0.02	
				AZPED21-06-LMM	GFRO100UJ	70	9.33E+12	1.85E+13							2.44	53.53	2.58	70.00	0.17	0.16	-0.09	
				AZPED21-07-LMM	GFRO100UK	90	9.64E+12	7.50E+12							2.03	58.79	0.00	90.00	0.00	0.00	0.00	
⁽¹⁾ Average of envelope signal over soil depth from this study																						
⁽²⁾ Bulk density from Bernhard et al., 2018																						
⁽³⁾ Grain size distribution from Bernhard et al., 2018																						
⁽⁴⁾ pH from Bernhard et al., 2018																						
⁽⁵⁾ Cation exchange capacity from Bernhard et al., 2018																						
⁽⁶⁾ Loss on Ignition LOI from Oesser et al., 2018																						
⁽⁷⁾ Chemical Index of Alteration CIA calculated based on data from Oesser et al., 2018																						
⁽⁸⁾ Mass transfer coefficient Tau calculated based on data from Oesser et al., 2018																						
⁽⁹⁾ Volumetric strain calculated based on data from Oesser et al., 2018																						

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Table S1B: Data compilation for regolith profiles																							
Soil profile	Location °S	°W	Altitude m	Sample	IGSN	Depth cm	GPR 500 ⁽¹⁾ MHz	GPR 1000 ⁽¹⁾ MHz	Bulk density ⁽²⁾	sand %	Grain size ⁽³⁾ silt %	clay %	pH ⁽⁴⁾	CEC ⁽⁵⁾ μmol/g	LOI ⁽⁶⁾	CIA ⁽⁷⁾	Ca	Na	Tau ⁽⁸⁾ K	Mg	Zr	Vol. strain ⁽⁹⁾	
Santa Gracia																							
SGPED10	29.75633	71.16626	727																				
SGPED20	29.75636	71.16721	718	SGPED20-01-LMM	GFR0100UL	2.5	2.40E+11	8.29E+11	1.57	78.1	14.0	7.8	7.01	89.26	2.94	48.50	-0.03	0.01	1.43	-0.17	-0.16	0.33	
				SGPED20-02-LMM	GFR0100UM	7.5	1.47E+11	5.86E+11	1.50	76.7	14.2	10.1	6.43	73.12	2.94	47.18	-0.10	-0.22	0.80	-0.09	0.03	0.14	
				SGPED20-03-LMM	GFR0100UN	15	5.09E+11	7.15E+12	1.49	71.8	15.2	13.0	6.38	116.94	2.86	46.90	-0.14	-0.18	0.48	-0.17	0.11	0.05	
				SGPED20-04-LMM	GFR0100UP	30	1.15E+13	1.93E+13	1.56	72.0	15.1	12.9	6.61	119.59	1.82	47.70	-0.16	-0.15	0.48	-0.23	0.11	0.00	
				SGPED20-05-LMM	GFR0100UQ	50	1.48E+13	1.56E+13							1.50	46.34	-0.11	-0.16	0.00	-0.26	0.19		
				SGPED20-06-LMM	GFR0100UR	70	7.81E+12	6.78E+12							1.55	45.91	-0.13	-0.21	0.49	-0.13	0.16		
				SGPED20-07-LMM	GFR0100US	90	5.73E+12	3.88E+12							1.57	46.31	-0.12	-0.10	1.02	-0.20	0.03		
				SGPED20-08-LMM	GFR0100UT	110	4.69E+12	3.07E+12							1.52	45.71	0.00	0.00	0.00	0.00	0.00		
SGPED30	29.75702	71.16650	705	SGPED30-01-LMM		2.5	3.15E+11	7.42E+11		68.5	21.9	9.6			2.76		-0.31	-0.38	-0.01	-0.34	0.33		
				SGPED30-02-LMM		7.5	2.41E+11	1.09E+12		72.4	16.8	10.8			2.27		-0.25	-0.31	0.04	-0.30	0.21		
				SGPED30-03-LMM		15	7.28E+11	2.16E+13		71.0	16.6	12.4			2.12		-0.26	-0.36	0.11	-0.26	0.15		
				SGPED30-04-LMM		30	1.92E+13	2.44E+13		69.5	16.9	13.6			2.48		-0.33	-0.38	-0.20	-0.32	0.35		
				SGPED30-05-LMM		50	2.26E+13	2.42E+13							1.65		-0.07	-0.19	0.13	-0.11	0.04		
				SGPED30-06-LMM		70	1.47E+13	1.44E+13							1.90		-0.13	-0.09	-0.14	-0.22	0.09		
				SGPED30-07-LMM		90	9.02E+12	5.39E+12							2.07		0.07	0.00	0.05	-0.02	-0.08		
				SGPED30-08-LMM		110	4.16E+12	3.79E+12							2.45		0.00	0.00	0.00	0.00	0.00		
SGPED40	29.75738	71.16635	682	SGPED40-01-RO	GFR0100UJ	2.5	2.55E+11	7.84E+11	1.48	76.8	17.5	5.6	6.28	44.75	3.89	47.70	-0.42	-0.48	-0.19	-0.40	0.69	-0.41	
				SGPED40-02-RO	GFR0100UV	7.5	2.26E+11	7.94E+11	1.55	78.9	15.3	5.8	6.29	51.05	1.96	48.40	-0.49	-0.54	-0.26	-0.43	0.84	-0.46	
				SGPED40-03-RO	GFR0100V3	15	7.59E+11	1.45E+13	1.55	78.6	13.9	7.5	6.18	52.49	1.93	48.84	-0.47	-0.50	-0.20	-0.42	0.72	-0.41	
				SGPED40-04-RO	GFR0100W	30	1.87E+13	2.08E+13	1.44	78.1	13.7	8.2	6.11	69.95	1.85	49.21	-0.44	-0.46	-0.23	-0.40	0.63	-0.37	
				SGPED40-05-RO	GFR0100UX	50	2.33E+13	1.76E+13	1.43	76.9	13.7	9.5	5.97	70.38	1.97	49.17	-0.07	-0.13	-0.07	0.06	0.05	0.00	
				SGPED40-06-RO	GFR0100UY	70	1.31E+13	1.71E+13		77.6	14.2	8.2	5.48	108.79	2.09	49.61	-0.14	-0.06	-0.17	0.06	0.05		
				SGPED40-07-RO	GFR0100UZ	90	1.65E+13	9.04E+12							2.20	51.30	-0.35	-0.17	-0.28	-0.04	0.17		
				SGPED40-08-RO	GFR0100V0	110	6.37E+12	4.29E+12							1.81	48.23	-0.43	-0.38	-0.52	-0.20	0.62		
SGPED50	29.75794	71.16618	652	SGPED40-09-RO	GFR0100V1	130	4.60E+12	3.31E+12							1.28	47.06	-0.10	-0.07	-0.27	0.01	0.10		
				SGPED40-10-RO	GFR0100V2	150	4.29E+12	4.09E+12							1.19	47.05	0.01	-0.06	0.07	0.09	0.00		
				SGPED40-11-RO	GFR0100CR	170	3.77E+12	5.76E+12							1.08	46.84	0.00	0.00	0.00	0.00	0.00		
				SGPED50-01-RO		2.5	2.36E+11	7.15E+11							2.89		0.60	0.14	0.37	0.13	-0.19		
				SGPED50-02-RO		7.5	2.04E+11	8.52E+11		75.1	13.5	11.3			2.73		0.32	-0.09	-0.07	0.01	0.05		
				SGPED50-03-RO		15	6.57E+11	1.78E+13							2.48		0.29	-0.18	-0.03	0.11	0.06		
				SGPED50-04-RO		30	1.58E+13	2.18E+13		71.9	15.1	13.0			2.65		0.35	-0.12	-0.10	0.12	0.04		
SGPED60	29.75826	71.16615	638	SGPED50-05-RO		50	1.62E+13	1.53E+13		77.3	10.5	12.2			1.79		0.85	0.12	0.30	0.37	-0.22		
				SGPED50-06-RO		70	1.08E+13	9.06E+12		77.4	12.1	10.5			1.82		0.99	0.19	0.26	0.66	-0.27		
				SGPED50-07-RO		90	6.18E+12	4.97E+12		77.9	13.0	9.1			1.49		0.58	-0.01	-0.24	0.19	-0.01		
				SGPED50-08-RO		110	3.98E+12	3.62E+12							1.56		0.60	0.01	0.11	0.17	-0.09		
				SGPED50-09-RO		130	2.61E+12	3.75E+12							1.24		0.58	-0.03	0.14	0.17	-0.08		
				SGPED50-10-RO		150	1.81E+12	4.58E+12							2.00		0.45	-0.10	0.02	0.15	-0.02		
				SGPED50-11-RO		170	1.89E+12	6.00E+12							2.12		0.00	0.00	0.00	0.00	0.00		
SGPED70	29.76120	71.16559	690	SGPED60-01-RO	GFR0100V4	2.5	2.42E+11	1.05E+12	1.53	77.6	16.0	6.4	6.57	71.15	2.26	48.79	-0.10	-0.13	-0.21	-0.06	0.15	-0.20	
				SGPED60-02-RO	GFR0100V5	7.5	2.05E+11	7.30E+11	1.47	79.6	14.1	6.3	6.58	68.05	1.90	49.18	-0.07	-0.05	-0.15	-0.09	0.07	-0.10	
				SGPED60-03-RO	GFR0100V6	15	5.95E+11	1.31E+13	1.45	75.6	16.7	7.6	6.64	68.31	2.83	48.93	-0.12	-0.13	-0.25	-0.02	0.15	-0.18	
				SGPED60-04-RO	GFR0100V7	30	1.36E+13	1.53E+13	1.46	76.2	13.7	8.1	6.03	68.11	1.97	49.50	-0.11	-0.11	-0.21	-0.05	0.11	-0.13	
				SGPED60-05-RO	GFR0100V8	50	1.32E+13	1.05E+13	1.42	73.6	15.7	10.6	5.94	96.93	1.74	49.78	-0.04	-0.01	-0.10	-0.06	0.01	0.00	
				SGPED60-06-RO	GFR0100V9	70	6.25E+12	8.79E+12 n.d.		65.8	8.2	6.1	5.99	109.51	1.78	49.32	0.17	0.15	-0.06	0.10	-0.09		
				SGPED60-07-RO	GFR0100VA	90	7.41E+12	6.55E+12 n.d.							1.82	50.36	0.07	0.11	0.06	0.04	-0.12		
				SGPED60-08-RO	GFR0100VB	110	5.42E+12	3.90E+12 n.d.							1.71	50.54	0.09	0.18	0.32	-0.10	-0.21		
SGPED70	29.76120	71.16559	690	SGPED60-09-RO	GFR0100VC	130	3.67E+12	3.52E+12 n.d.							1.68	50.07	0.01	0.07	0.37	-0.09	-0.16		
				SGPED60-10-RO	GFR0100VD	150	3.02E+12	4.76E+12 n.d.							1.55	49.42	0.11	0.13	0.12	-0.05	-0.08		
				SGPED60-11-RO	GFR0100VE	170	2.71E+12	6.26E+12 n.d.							1.42	49.53	0.00	0.00	0.00	0.00	0.00		
				SGPED70-01-RO	GFR0100VF	2.5	3.94E+11	5.72E+11	1.54	74.8	14.9	10.3	6.21	74.97	2.29	48.73	-0.22	-0.27	-0.44	-0.38	0.40	-0.18	
				SGPED70-02-RO	GFR0100VG	7.5	2.28E+11	6.01E+11	1.62					84.42	2.33	49.81	-0.12	-0.04	-0.31	-0.27	0.13	0.02	
				SGPED70-03-RO	GFR0100VH	15	4.89E+11	1.49E+13	1.65						5.77	2.29	50.93	-0.09	-0.01	-0.23	-0.20	0.04	0.11
				SGPED70-04-RO	GFR0100VJ	30	1.12E+13	2.22E+13	1.66						2.59	51.73	-0.11	-0.09	-0.24	-0.16	0.06	0.00	
SGPED70	29.76120	71.16559	690	SGPED70-05-RO	GFR0100VK	50	1.21E+13	7.21E+12							2.64	49.43	0.04	0.01	-0.21	0.05	0.00		
				SGPED70-06-RO	GFR0100VL	70	1.54E+12	2.11E+12							1.34	48.41	0.02	0.03	-0.07	0.05	-0.02		
				SGPED70-07-RO	GFR0100VM	90	1.71E+12	2.70E+12							1.56	48.38	0.21	0.21	-0.02	0.28	-0.17		
				SGPED70-08-RO	GFR0100VN	110	1.09E+12	3.20E+12							1.48	46.65	-0.01	-0.07	-0.08	0.10	0.06		
				SGPED70-09-RO	GFR0100VP	130	1.15E+12	3.83E+12							1.21	47.08	0.00	0.13	0.01	0.00	0.00	0.01	
				SGPED70-10-RO	GFR0100VQ	150	1.28E+12	4.90E+12							1.11	46.84	0.16	0.13	0.01	0.18	-0.07		
				SGPED70-11-RO	GFR0100VR	170	1.69E+12	6.41E+12							1.36	47.24	0.00	0.00	0.00	0.00	0.00	0.00	
				(1) Average of envelope signal over soil depth from this study																			
(2) Bulk density from Bernhard et al., 2018																							
(3) Grain size distribution from Bernhard et al., 2018																							
(4) pH from Bernhard et al., 2018																							
(5) Cation exchange capacity from Bernhard et al., 2018																							
(6) Loss on ignition LOI from Oesser et al., 2018																							
(7) Chemical Index of Alteration CIA calculated based on data from Oesser et al., 2018																							
(8) Mass transfer coefficient Tau calculated based on data from Oesser et al., 2018																							
(9) Volumetric strain calculated based on data from Oesser et al., 2018																							

data compilation for regolith profiles																					
Location		Altitude	Sample	IGSN	Depth	GPR 500 ⁽¹⁾	GPR 1000 ⁽¹⁾	Bulk density ⁽²⁾	Grain size ⁽³⁾			pH ⁽⁴⁾	CEC ⁽⁵⁾	LOI ⁽⁶⁾	CIA ⁽⁷⁾	Ca	Na	Tau ⁽⁸⁾		Zr	Vol. strain ⁽⁹⁾
"S	"W	m			cm	MHz	MHz		sand %	silt %	clay %		μmol/g					K	Mg		
32.95581	71.06332	734	LCPED10-01-RO	GFR010021	2.5	3.57E+11	8.02E+11	1.15	71.7	20.5	7.8	5.92	256.37	13.70	51.59	2.07	-0.45	-0.59	0.65	0.83	-0.32
			LCPED10-02-RO	GFR010022	7.5	3.61E+11	1.14E+12	1.25	73.4	19.7	6.9	5.78	104.37	5.34	53.50	1.59	-0.44	-0.60	0.62	0.85	-0.36
			LCPED10-03-RO	GFR010023	15	1.17E+12	3.39E+13	1.22	73.5	19.2	7.3	5.50	63.07	3.95	54.24	1.46	-0.43	-0.58	0.62	0.79	-0.36
			LCPED10-04-RO	GFR010024	30	2.37E+13	3.28E+13	1.39	75.4	16.7	7.9	5.12	51.54	3.13	55.78	1.12	-0.35	-0.46	0.51	0.55	-0.30
			LCPED10-05-RO	GFR0100V5	50	1.74E+13	2.53E+13	1.57	79.3	13.0	7.7	4.69	41.90	3.29	57.57	0.57	-0.22	-0.22	0.32	0.19	-0.17
			LCPED10-06-RO	GFR0100VT	70	3.03E+13	2.09E+13	1.56	84.3	10.4	5.3	4.53	39.24	3.56	57.38	0.00	0.00	0.00	0.00	0.00	0.00
32.95588	71.06355	718	LCPED20-01-RO	GFR010029	2.5	4.13E+11	1.41E+12	0.64	73.2	17.1	9.7	5.55		13.80	51.12	0.35	-0.15	-0.13	0.19	0.03	0.85
			LCPED20-02-RO	GFR01002A	7.5	2.85E+11	8.73E+11	1.04	74.7	16.5	8.9	5.34	233.68	4.19	53.62	-0.01	-0.16	-0.19	0.12	0.10	0.38
			LCPED20-03-RO	GFR01002B	15	5.77E+11	1.51E+13	1.23	75.4	15.1	9.5	5.31	110.00	4.75	54.82	-0.02	-0.12	-0.14	0.22	0.06	0.12
			LCPED20-04-RO	GFR01002C	30	1.41E+13	2.82E+13	1.25	75.5	14.1	10.5	5.06	78.61	4.71	54.78	0.04	-0.08	-0.11	0.39	0.01	0.20
			LCPED20-05-RO	GFR01002D	50	1.95E+13	4.66E+13	1.40	76.6	14.5	8.9	4.88	69.35	5.11	54.40	-0.07	-0.22	-0.23	0.29	0.18	-0.13
			LCPED20-06-RO	GFR0100VU	70	2.49E+13	1.92E+13	1.49	83.4	11.4	5.3	4.84	53.77	3.53	53.34	0.67	0.19	0.03	1.52	-0.17	0.17
			LCPED20-07-RO	GFR0100VV	90	1.57E+13	7.44E+12	1.54	84.5	8.9	6.6	4.64	46.80	2.71	53.78	0.49	0.13	0.03	1.14	-0.16	0.12
			LCPED20-08-RO	GFR0100VW	110	5.60E+12	6.63E+12	1.47	86.2	9.8	4.2	4.63	47.25	3.46	53.34	0.21	-0.01	-0.12	0.66	-0.02	-0.01
			LCPED20-09-RO	GFR0100VY	130	4.58E+12	6.57E+12	1.53	88.5	6.6	4.9	4.50	29.50	2.10	53.37	-0.02	-0.08	-0.17	0.12	0.08	-0.13
			LCPED20-10-RO	GFR0100VX	150	3.43E+12	7.02E+12	1.44	86.1	8.8	5.2	4.81	25.97	1.76	52.46	0.00	0.00	0.00	0.00	0.00	0.00
32.95615	71.06380	708	LCPED30-01-RO	GFR01002Q	2.5	3.55E+11	1.02E+12	1.16	70.4	18.1	11.5	6.08	265.09	10.07	51.72	0.10	-0.29	-0.27	0.23	0.22	0.36
			LCPED30-02-RO	GFR01002R	7.5	2.61E+11	7.40E+11	1.31	68.7	19.4	11.9	5.90	214.96	3.67	50.93	0.18	-0.31	-0.28	0.24	0.22	0.27
			LCPED30-03-RO	GFR01002S	15	7.64E+11	1.57E+13	1.25	73.1	17.1	9.8	5.94	107.99	4.75	52.07	-0.02	-0.32	-0.37	0.26	0.33	0.17
			LCPED30-04-RO	GFR01002T	30	1.60E+13	2.63E+13	1.09	73.8	16.0	10.2	5.92	90.85	3.50	51.94	0.07	-0.25	-0.32	0.42	0.23	0.30
			LCPED30-05-RO	GFR01002U	50	1.43E+13	1.75E+13	1.15	76.6	14.4	9.1	5.83	84.92	4.09	50.82	0.30	-0.08	-0.25	0.65	0.08	0.60
			LCPED30-06-RO	GFR0100VZ	70	9.84E+12	1.19E+13	1.37	90.8	6.2	3.1	5.87	66.37	2.58	49.74	0.44	0.04	-0.18	0.66	-0.01	0.46
			LCPED30-07-RO	GFR0100W0	90	6.52E+12	6.35E+12	1.60	90.8	6.2	3.1	5.97	42.66	4.49	48.98	0.81	0.32	-0.03	1.02	-0.18	0.50
			LCPED30-08-RO	GFR0100W1	110	4.40E+12	5.29E+12	1.69	90.9	6.2	2.9	5.92	53.27	1.89	48.82	0.59	0.15	-0.23	0.80	-0.05	0.23
			LCPED30-09-RO	GFR0100W2	130	3.87E+12	5.93E+12	1.80	88.8	7.0	4.1	5.72	66.23	2.01	49.08	0.51	0.13	-0.14	0.61	-0.05	0.16
			LCPED30-10-RO	GFR0100W3	150	2.75E+12	5.87E+12	1.76	90.3	5.4	4.3	5.80	60.10	2.13	49.20	0.69	0.23	-0.11	0.92	-0.14	0.31
			LCPED30-11-RO	GFR0100W4	170	3.12E+12	7.14E+12	1.70	89.3	7.5	3.2	5.62	58.46	1.97	49.68	0.67	0.29	0.01	0.73	-0.18	0.41
			LCPED30-12-RO	GFR0100W5	190	3.76E+12	7.18E+12	1.60	92.0	5.8	2.3	5.68	52.91	2.21	49.33	0.28	-0.03	-0.28	0.51	0.10	0.12
			LCPED30-13-RO	GFR0100W6	210	3.55E+12	4.97E+12	1.64	93.1	5.5	1.4	5.76	59.30	1.93	48.91	0.10	-0.19	-0.37	0.28	0.32	-0.09
			LCPED30-14-RO	GFR0100W7	230	1.98E+12	4.97E+12	1.64	93.5	5.0	1.6	5.74	52.38	1.73	48.90	0.53	0.18	-0.20	0.74	-0.05	0.27
			LCPED30-15-RO	GFR0100W8	250	1.59E+12		1.62	91.5	6.6	1.9	5.61	48.02	1.88	49.12	0.50	0.14	-0.22	0.71	-0.03	0.26
			LCPED30-16-RO	GFR0100W8	270			1.55	91.8	5.6	2.6	5.55	59.82	2.07	49.73	0.65	0.28	-0.06	0.92	-0.15	0.51
LCPED30-17-RO	GFR0100W9	290			1.64	90.0	8.3	1.6	5.30	59.85	1.75	49.39	0.26	-0.04	-0.22	0.53	0.10	0.10			
LCPED30-18-RO	GFR0100W8	310			1.60	89.8	8.0	2.2	5.42	57.53	1.91	49.37	0.64	0.37	-0.25	0.82	-0.14	0.43			
LCPED30-19-RO	GFR0100WC	330			1.66	91.6	6.1	2.3	5.45	61.57	1.93	49.43	0.09	-0.11	-0.30	0.32	0.19	0.00			
LCPED30-20-RO	GFR0100WD	350			1.72	91.1	6.0	2.8	5.34	47.63	1.74	50.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
32.95720	71.06425	724	LCPED40-01-LMM	GFR01002V	2.5	4.72E+11	1.46E+12	1.30	72.5	18.3	9.2	5.74	191.97	9.95	52.24	-0.28	-0.49	-0.44	-0.14	0.65	-0.31
			LCPED40-02-LMM	GFR01002W	7.5	3.14E+11	8.26E+11	1.35	72.8	18.9	8.3	5.37	92.10	4.28	52.94	-0.39	-0.50	-0.44	-0.22	0.71	-0.40
			LCPED40-03-LMM	GFR01002X	15	8.01E+11	1.40E+13	1.51	73.3	17.2	9.5	5.06	74.86	3.40	54.81	-0.31	-0.42	-0.35	-0.03	0.45	-0.35
			LCPED40-04-LMM	GFR01002Y	30	1.15E+13	2.03E+13	1.53	70.2	17.4	12.4	4.93	78.34	3.31	55.80	-0.25	-0.36	-0.25	0.08	0.26	-0.26
			LCPED40-05-LMM	GFR01002Z	50	1.74E+13	2.16E+13	1.53	68.9	17.1	14.0	5.05	80.66	2.96	55.39	-0.23	-0.31	-0.13	0.11	0.18	-0.17
			LCPED40-06-LMM	GFR010030	70	2.23E+13	8.83E+12	1.59	69.0	17.5	13.5	4.96	82.85	3.16	57.07	-0.20	-0.27	-0.02	0.15	0.04	-0.14
			LCPED40-07-LMM	GFR0100WG	90	1.34E+13	3.33E+12	1.69	69.5	16.5	14.1	5.02	84.75	3.45	57.35	-0.26	-0.33	-0.16	0.07	0.14	-0.26
			LCPED40-08-LMM	GFR0100WF	110	1.00E+13	3.20E+12	1.48	75.0	14.3	10.7	5.02	55.79	2.65	55.41	-0.26	-0.29	-0.20	-0.06	0.19	-0.19
			LCPED40-09-LMM	GFR0100WE	130	9.04E+12	3.49E+12	1.42	89.2	6.5	4.3	5.31	36.59	1.69	51.29	0.00	0.00	0.00	0.00	0.00	0.00
envelope signal over soil depth from this study																					
from Bernhardt et al., 2018																					
contribution from Bernhardt et al., 2018																					
hard et al., 2018																					
pore capacity from Bernhardt et al., 2018																					
on LOI from Oeser et al., 2018																					
index of Alteration CIA calculated based on data from Oeser et al., 2018																					
coefficient Tau calculated based on data from Oeser et al., 2018																					
grain calculated based on data from Oeser et al., 2018																					

Table S1D: Data compilation for regolith profiles																			
Soil profile	Location	Altitude	Sample	IGSN	Depth	GPR 500 ⁽¹⁾	GPR 1000 ⁽¹⁾	Bulk density ⁽²⁾	Grain size ⁽³⁾	pH ⁽⁴⁾	CEC ⁽⁵⁾	LOI ⁽⁶⁾	CIA ⁽⁷⁾	Ca	Na	Tau ⁽⁸⁾	Mg	Zr	Vol. strain ⁽⁹⁾
'S	'W	m			cm	MHz	MHz		sand %	silt %	clay %					K			
Nahuelbuta																			
NAPED10	37.80735	73.01285	1248	NAPED10-01-RO	GFRO1000H	2.5	1.31E+12	0.58	54.5	22.2	23.3	3.67	118.39	28.33	68.62	-0.28	-0.32	-0.18	0.00
				NAPED10-02-RO	GFRO1000J	7.5	6.32E+11	0.64	55.5	20.8	23.7	3.94	80.35	22.47	70.23	-0.31	-0.34	-0.13	0.08
				NAPED10-03-RO	GFRO1000K	15	3.38E+12	0.83	56.8	21.0	22.2	4.10	68.45	18.38	70.00	-0.30	-0.34	-0.18	0.05
				NAPED10-04-RO	GFRO1000L	30	8.74E+13	0.91	54.5	20.7	24.9	4.40	42.18	10.37	68.40	-0.29	-0.34	-0.21	-0.06
				NAPED10-05-RO	GFRO1000M	50	1.04E+14	1.09	60.1	18.7	21.2	4.58	33.75	7.29	68.73	-0.17	-0.22	-0.19	-0.02
				NAPED10-06-RO	GFRO1000N	70	4.99E+13	1.05	76.4	14.2	9.4	4.48	25.53	7.16	68.05	-0.30	-0.32	-0.24	0.11
				NAPED10-07-RO	GFRO1000P	90	4.81E+13	1.04	80.7	10.8	8.5	4.52	22.34	4.90	63.46	-0.09	-0.11	-0.18	0.15
				NAPED10-08-RO	GFRO1000Q	110	6.75E+13	1.00	89.0	6.1	5.0	4.86	13.66	3.50	58.23	0.30	0.32	0.09	0.31
				NAPED10-09-RO	GFRO1000R	130	5.97E+13	1.01	88.0	7.1	4.9	4.85	12.38	3.12	59.01	0.21	0.19	0.07	0.39
				NAPED10-10-RO	GFRO1000S	150	3.43E+13	1.08	88.7	6.9	4.4	4.85	10.91	3.10	58.37	0.19	0.18	0.10	0.42
				NAPED10-11-RO	GFRO1000T	170	2.05E+13	1.13	88.5	8.1	3.4	4.88	10.12	3.07	56.30	0.07	0.10	0.11	0.13
				NAPED10-12-RO	GFRO1000U	190	1.72E+13	1.24	92.5	4.8	2.7	5.05	5.19	4.91	55.42	0.11	0.14	0.02	0.08
				NAPED10-13-RO	GFRO1000V	210	1.24E+13		95.0	4.3	0.7	4.21	4.53	2.31	55.22	0.00	0.00	0.00	0.00
NAPED20																			
NAPED20	37.80770	73.01357	1239	NAPED20-01-LMM	GFRO10019	2.5	6.77E+11	0.86	56.0	19.5	24.5	4.01	97.05	26.07	72.23	-0.64	-0.61	-0.71	-0.87
				NAPED20-02-LMM	GFRO10018	7.5	4.40E+11	0.72	53.7	19.5	26.8	4.07	75.30	24.51	73.68	-0.67	-0.62	-0.76	-0.87
				NAPED20-03-LMM	GFRO1001A	15	6.98E+12	0.74	51.3	21.1	27.6	4.15	69.19	22.00	74.06	-0.67	-0.62	-0.75	-0.87
				NAPED20-04-LMM	GFRO1001B	30	5.48E+13	0.77	51.2	21.4	27.4	4.33	45.43	15.02	73.88	-0.67	-0.62	-0.76	-0.87
				NAPED20-05-LMM	GFRO1001C	50	4.09E+13	0.86	52.1	21.2	26.8	4.41	29.01	6.85	69.41	-0.64	-0.49	-0.55	-0.88
				NAPED20-06-LMM	GFRO1001D	70	2.43E+13	1.18	64.0	18.6	17.4	4.19	38.59	8.93	75.44	-0.64	-0.69	-0.51	-0.69
				NAPED20-07-LMM	GFRO100WP	90	2.13E+13	1.07	78.3	12.7	9.0	4.21	41.86	7.74	67.18	3.42	0.64	1.62	2.36
				NAPED20-08-LMM	GFRO100WN	110	3.50E+13	0.89	80.0	11.8	8.2	4.27	27.73	6.67	61.56	2.12	0.14	0.12	0.79
				NAPED20-09-LMM	GFRO100WM	130	2.70E+13	0.90	81.1	11.9	7.1	4.46	15.60	6.88	59.57	0.73	-0.25	-0.45	-0.20
				NAPED20-10-LMM	GFRO100WL	150	3.09E+13	1.05	77.9	13.6	8.5	4.48	15.47	6.91	65.57	0.79	-0.19	-0.22	-0.01
				NAPED20-11-LMM	GFRO100WK	170	4.48E+13	0.81	77.8	14.6	7.6	4.18	37.86	8.18	79.01	-0.32	-0.50	0.32	0.11
				NAPED20-12-LMM	GFRO100WQ	190	3.30E+13	0.93	81.2	12.3	6.5	4.25	28.72	7.03	73.65	0.32	-0.01	0.39	0.47
				NAPED20-13-LMM	GFRO100WR	210	1.17E+13		80.3	11.5	6.2	4.42	19.37	6.85	73.55	0.08	-0.13	-0.04	0.13
				NAPED20-14-LMM	GFRO100WJ	230	8.04E+12		82.4	11.7	5.9	4.52	16.05	7.11	71.99	0.36	0.20	0.09	0.29
				NAPED20-15-LMM	GFRO100WH	250	5.27E+12		83.6	10.8	5.6	4.58	15.50	6.91	72.42	0.00	0.00	0.00	0.00
NAPED30																			
NAPED30	37.80838	73.01345	1228	NAPED30-01-RO	GFRO1001F	2.5	3.42E+12	0.86	49.4	22.8	27.9	4.38	82.65	23.70	67.12	-0.64	-0.51	-0.65	-0.40
				NAPED30-02-RO	GFRO1001G	7.5	1.27E+12	0.71	47.1	24.1	28.8	4.18	61.78	21.64	67.92	-0.66	-0.51	-0.65	-0.42
				NAPED30-03-RO	GFRO1001H	15	3.51E+12	0.75	47.5	23.5	29.0	4.23	60.28	21.24	69.00	-0.69	-0.54	-0.68	-0.48
				NAPED30-04-RO	GFRO1001J	30	2.54E+13	0.84	47.6	26.4	26.1	4.36	37.22	17.27	69.39	-0.69	-0.52	-0.66	-0.44
				NAPED30-05-RO	GFRO1001K	50	2.94E+13	0.84	51.2	29.1	19.7	4.48	27.41	11.05	67.47	-0.63	-0.36	-0.42	-0.35
				NAPED30-06-RO	GFRO100WU	70	5.19E+13	1.12	61.0	19.3	19.8	4.49	27.34	7.81	68.41	-0.67	-0.20	-0.31	-0.35
				NAPED30-07-RO	GFRO100WT	90	1.06E+14	1.34	75.4	16.1	8.5	4.39	19.85	5.25	68.88	-0.66	-0.01	-0.22	-0.24
				NAPED30-08-RO	GFRO100WS	110	1.30E+14	1.59	87.5	8.4	4.1	4.53	8.21	2.64	54.48	0.00	0.00	0.00	0.00
NAPED40																			
NAPED40	37.80904	73.01380	1200	NAPED40-01-RO	GFRO1001R	2.5	3.23E+12	0.78	59.7	20.5	20.0	4.67	47.67	14.91	72.64	0.34	-0.02	0.22	0.51
				NAPED40-02-RO	GFRO1001S	7.5	1.28E+12	0.90	59.1	20.9	21.2	4.52	42.58	16.03	73.55	0.24	-0.08	0.13	0.51
				NAPED40-03-RO	GFRO1001T	15	4.33E+12	0.92	54.7	24.1	22.4	4.51	42.61	16.19	73.55	0.25	-0.07	0.15	0.52
				NAPED40-04-RO	GFRO1001U	30	1.79E+13	0.97	55.3	22.3	16.9	4.57	32.00	13.35	74.70	0.11	-0.16	0.06	0.45
				NAPED40-05-RO	GFRO1001V	50	5.15E+13	1.19	64.8	18.3	13.7	4.80	11.87	4.19	66.21	0.29	1.55	1.34	0.38
				NAPED40-06-RO	GFRO100X0	70	7.35E+13	1.15	71.1	15.2	8.6	4.83	7.95	3.61	65.85	0.28	0.16	0.22	0.16
				NAPED40-07-RO	GFRO100S0	90	1.03E+14	1.22	79.8	11.6	8.1	4.90	7.49	4.02	67.05	-0.09	-0.17	0.32	-0.03
				NAPED40-08-RO	GFRO100WZ	110	1.14E+14	1.20	79.7	11.2	8.5	4.76	10.35	4.67	71.07	0.21	0.01	0.92	0.68
				NAPED40-09-RO	GFRO100WY	130	8.47E+13	1.21	78.9	12.6	7.3	4.73	13.71	5.07	72.70	-0.03	-0.16	0.34	0.61
				NAPED40-10-RO	GFRO100WX	150	8.09E+13	1.27	78.5	14.3	5.3	4.73	14.94	4.31	69.07	-0.06	-0.16	0.22	0.33
				NAPED40-11-RO	GFRO100WV	170	5.79E+13	n.d.	83.6	11.0	6.9	4.67	9.87	3.38	64.89	1.00	0.10	0.52	1.35
				NAPED40-12-RO	GFRO100WV	190	3.39E+13	n.d.	81.3	11.9		4.91	11.32	3.18	67.14	0.00	0.00	0.00	0.00
Footnotes:																			
⁽¹⁾ Average of envelope signal over soil depth from this study																			
⁽²⁾ Bulk density from Bernhardt et al., 2018																			
⁽³⁾ Grain size distribution from Bernhardt et al., 2018																			
⁽⁴⁾ pH from Bernhardt et al., 2018																			
⁽⁵⁾ Cation exchange capacity from Bernhardt et al., 2018																			
⁽⁶⁾ Loss on ignition LOI from Oesser et al., 2018																			
⁽⁷⁾ Chemical Index of Alteration CIA calculated based on data from Oesser et al., 2018																			
⁽⁸⁾ Mass transfer coefficient Tau calculated based on data from Oesser et al., 2018																			
⁽⁹⁾ Volumetric strain calculated based on data from Oesser et al., 2018																			

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TableS2A to D

Table S2A: Data compilation for regolith profiles																								
Soil profile	Location °S	°W	Altitude m	Sample	IGSN	Depth cm	GPR 500 ⁽¹⁾ MHz	GPR 1000 ⁽¹⁾ MHz	Bulk density ⁽²⁾	Grain size ⁽³⁾				pH ⁽⁴⁾	CEC ⁽⁵⁾ μmolog	LOI ⁽⁶⁾	CIA ⁽⁷⁾	Ca	Na	Tau ⁽⁸⁾ K		Mg	Zr	Vol. strain ⁽⁹⁾
										sand %	silt %	clay %	K							Mg				
Pan de Azúcar																								
AZPED60	26.11012	70.54922	343	AZPED60-01-RO	GFRO100TP	5.00	3.93E+11	1.83E+12	-0.031	0.691	-0.951	0.280	0.022	0.000	-0.048	-0.665	0.109	0.024	0.056	-0.101	-0.114	0.046		
				AZPED60-02-RO	GFRO100TQ	11.25	2.81E+11	2.01E+12		-1.663	0.629	1.033	-0.003	0.000	0.197	-3.763	0.715	-0.001	-0.018	0.250	-0.040			
				AZPED60-03-RO	GFRO100TR	22.50	7.50E+11	3.09E+13		-0.173	0.852	-0.679	-0.009	0.000	0.005	0.429	-0.163	0.024	0.002	-0.052	-0.004			
				AZPED60-04-RO	GFRO100TS	40.00	1.63E+13	2.95E+13							-0.100	1.047	-0.156	0.004	0.002	-0.089	0.009			
				AZPED60-05-RO	GFRO100TT	60.00	2.21E+13	1.93E+13							-0.011	0.192	-0.002	-0.006	0.002	-0.002	-0.006			
				AZPED60-06-RO	GFRO100TU	80.00	1.06E+13	1.10E+13							-0.023	-0.022	0.006	0.007	0.016	0.000	-0.017			
				AZPED60-07-RO	GFRO100TW	100.00	6.22E+12	6.95E+12							0.008	-0.041	0.001	-0.001	-0.003	-0.001	0.006			
				AZPED60-08-RO	GFRO100TV																			
AZPED50																								
	26.11027	70.54922	333	AZPED50-01-RO	GFRO100TX	5.00	3.37E+11	1.96E+12	0.080				0.018	0.000	-0.056	-3.105	0.328	0.058	0.051	-0.122	-0.075	-0.021		
				AZPED50-02-RO	GFRO100TY	11.25	2.26E+11	2.64E+12							-0.169	2.063	-0.224	0.000	0.019	-0.037	0.009			
				AZPED50-03-RO	GFRO100TZ	22.50	8.86E+11	4.07E+13							0.000	-0.112	0.004	-0.001	-0.013	-0.006	0.006			
				AZPED50-04-RO	GFRO100U0	40.00	1.72E+13	2.90E+13							0.037	-0.048	0.011	-0.001	-0.002	0.009	-0.005			
				AZPED50-05-RO	GFRO100U1	60.00	2.32E+13	1.36E+13							-0.009	0.098	-0.009	-0.009	-0.007	-0.005	0.005			
				AZPED50-06-RO	GFRO100U2	80.00	1.47E+13	7.76E+12							0.055	-0.443	0.046	-0.004	0.005	0.020	-0.006			
				AZPED50-07-RO	GFRO100U3	100.00	1.38E+13	6.06E+12							-0.043	0.364	-0.038	0.008	0.003	-0.016	0.004			
				AZPED50-08-RO	GFRO100U4		7.58E+12	5.85E+12							0.037	-0.082	0.010	-0.004	-0.007	0.004	0.001			
				AZPED50-09-RO	GFRO100U5	120.00																		
AZPED40																								
	26.11024	70.54921	326	AZPED40-01-RO	GFRO100BJ	5.00	2.92E+11	1.69E+12	0.049	-1.173	0.239	0.935	0.000	0.000	0.138	-1.134	0.129	-0.037	0.037	0.030	-0.014	0.035		
				AZPED40-02-RO	GFRO100B6	11.25	2.31E+11	2.39E+12		-2.546	2.808	-0.262	0.017	0.000	0.064	-1.467	0.201	-0.038	0.007	-0.001	-0.020			
				AZPED40-03-RO	GFRO100U7	22.50	9.48E+11	3.53E+13							-0.199	1.800	-0.162	-0.005	0.001	-0.019	0.012			
				AZPED40-04-RO	GFRO100U8	40.00	1.95E+13	3.10E+13							0.036	-0.106	-0.002	0.022	-0.010	-0.012	0.005			
				AZPED40-05-RO	GFRO100U9	60.00	2.33E+13	1.30E+13							0.040	-0.338	0.015	0.008	0.001	-0.002	-0.004			
				AZPED40-06-RO	GFRO100UA	80.00	7.12E+12	6.31E+12							0.094	-0.133	0.018	-0.014	0.005	0.017	-0.002			
				AZPED40-07-RO	GFRO100UB	100.00	4.37E+12	5.91E+12							-0.070	0.059	-0.013	0.019	-0.003	-0.008	-0.001			
				AZPED40-08-RO	GFRO100UC																			
AZPED21																								
	26.10936	70.54907	342	AZPED21-01-LMM	GFRO100UD	5.00	2.73E+11	8.47E+11	0.035	2.053	-1.868	-0.185	0.004	0.000	-0.070	0.129	0.107	0.026	0.018	-0.114	-0.028	0.028		
				AZPED21-02-LMM	GFRO100UE	11.25	1.71E+11	9.89E+11	-0.006	-1.070	-0.176	1.247	-0.004	0.000	-0.145	0.278	-0.180	-0.029	-0.010	-0.053	0.013	0.030		
				AZPED21-03-LMM	GFRO100UF	22.50	5.59E+11	2.51E+13		-1.138	1.133	0.004	-0.009	0.000	0.122	-0.575	0.349	0.004	-0.006	-0.014	0.010			
				AZPED21-04-LMM	GFRO100UG	40.00	1.08E+13	1.84E+13							-0.091	0.836	-0.485	-0.001	0.003	-0.031	-0.006			
				AZPED21-05-LMM	GFRO100UH	60.00	1.67E+13	2.18E+13							-0.031	-0.188	0.052	0.013	0.018	-0.018	-0.004			
				AZPED21-06-LMM	GFRO100UJ	80.00	9.33E+12	1.85E+13							-0.021	0.263	-0.129	-0.005	-0.008	-0.008	0.005			
				AZPED21-07-LMM	GFRO100UK																			
⁽¹⁾ Average of envelope signal over soil depth from this study																								
⁽²⁾ Bulk density from Bernhardt et al., 2018																								
⁽³⁾ Grain size distribution from Bernhardt et al., 2018																								
⁽⁴⁾ pH from Bernhardt et al., 2018																								
⁽⁵⁾ Cation exchange capacity from Bernhardt et al., 2018																								
⁽⁶⁾ Loss on ignition LOI from Oesser et al., 2018																								
⁽⁷⁾ Chemical Index of Alteration CIA calculated based on data from Oesser et al., 2018																								
⁽⁸⁾ Mass transfer coefficient Tau calculated based on data from Oesser et al., 2018																								
⁽⁹⁾ Volumetric strain calculated based on data from Oesser et al., 2018																								

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Table S2B: Data compilation for regolith profiles																						
Soil profile	Location	Altitude	Sample	IGSN	Depth	GPR 500 ⁽¹⁾	GPR 1000 ⁽¹⁾	Bulk density ⁽²⁾	Grain size ⁽³⁾	clay	pH ⁽⁴⁾	CEC ⁽⁵⁾	LOI ⁽⁶⁾	CIA ⁽⁷⁾	Ca	Na	K	Mg	Zr	Vol. strain ⁽⁸⁾		
	'S	'W	m		cm	MHz	MHz	g cm ⁻³	sand %	silt %	%	μmol/g	%	%	%	%	%	%	%	%		
Santa Gracia																						
SGPED10	29.75633	71.16626	727																			
SGPED20	29.75636	71.16721	718	SGPED20-01-LMM	GFR0100UL	5.00	2.395E+11	8.287E+11	-0.014	-0.485	0.041	0.443	-0.116	-3.227	0.000	-0.264	-0.014	-0.046	-0.125	0.017	0.037	-0.038
				SGPED20-02-LMM	GFR0100UM	11.25	1.568E+11	6.910E+11	-0.001	-0.521	0.125	0.396	-0.007	5.842	-0.011	-0.036	-0.006	0.006	-0.043	-0.011	0.011	-0.013
				SGPED20-03-LMM	GFR0100UN	22.50	8.200E+11	1.219E+13	0.005	0.014	-0.005	-0.009	0.015	0.177	-0.069	0.054	-0.001	0.001	0.000	0.004	-0.001	-0.003
				SGPED20-04-LMM	GFR0100UP	40.00	1.319E+13	1.846E+13							-0.016	-0.068	0.003	0.000	-0.024	-0.001	0.004	
				SGPED20-05-LMM	GFR0100UQ	60.00	1.481E+13	1.558E+13							0.003	-0.021	-0.001	-0.002	0.024	0.007	-0.001	
				SGPED20-06-LMM	GFR0100UR	80.00	7.812E+12	6.776E+12							0.001	0.020	0.001	0.005	0.026	-0.004	-0.007	
				SGPED20-07-LMM	GFR0100US	100.00	5.727E+12	3.880E+12							-0.003	-0.030	0.006	0.005	-0.051	0.010	-0.002	
				SGPED20-08-LMM	GFR0100UT																	
SGPED30	29.75702	71.16650	705	SGPED30-01-LMM		5.00	3.149E+11	7.418E+11		0.790	-1.036	0.246		-0.098		0.012	0.015	0.011	0.007	-0.025		
				SGPED30-02-LMM		11.25	2.478E+11	1.204E+12		-0.192	-0.017	0.209		-0.020		0.006	0.007	0.010	0.006	-0.008		
				SGPED30-03-LMM		22.50	1.050E+12	2.638E+13		-0.101	0.019	0.082		0.024		-0.008	-0.008	-0.021	-0.004	0.014		
				SGPED30-04-LMM		40.00	2.218E+13	2.230E+13							-0.042		0.013	0.009	0.017	0.011	-0.015	
				SGPED30-05-LMM		60.00	2.257E+13	2.417E+13							0.013		-0.003	0.005	0.014	-0.005	0.002	
				SGPED30-06-LMM		80.00	1.467E+13	1.442E+13							0.009		0.010	0.004	0.010	0.010	-0.009	
				SGPED30-07-LMM		100.00	9.019E+12	5.391E+12							0.019		-0.004	0.000	-0.003	0.001	0.004	
				SGPED30-08-LMM																		
SGPED40	29.75738	71.16635	682	SGPED40-01-RO	GFR0100UJ	5.00	2.547E+11	7.841E+11	0.015	0.411	-0.446	0.035	0.002	1.260	0.014	0.141	-0.013	-0.011	-0.014	-0.006	0.029	-0.011
				SGPED40-02-RO	GFR0100UV	11.25	2.583E+11	9.233E+11	0.000	-0.042	-0.183	0.225	-0.015	0.192	-0.004	0.059	0.003	0.005	0.008	0.001	-0.016	0.006
				SGPED40-03-RO	GFR0100VJ	22.50	1.137E+12	2.024E+13	-0.008	-0.032	-0.014	0.046	-0.005	0.498	-0.005	0.024	0.002	0.003	-0.002	0.002	-0.006	0.003
				SGPED40-04-RO	GFR0100UW	40.00	2.158E+13	1.880E+13	0.000	-0.062	-0.001	0.063	-0.007	0.521	0.006	-0.002	0.019	0.017	0.008	0.023	-0.029	0.018
				SGPED40-05-RO	GFR0100UX	60.00	2.332E+13	1.758E+13		0.036	0.027	-0.063	-0.025	1.921	0.006	0.022	-0.004	0.003	-0.005	0.000	0.000	
				SGPED40-06-RO	GFR0100UY	80.00	1.314E+13	1.708E+13							0.006	0.085	-0.010	-0.005	-0.006	-0.005	0.006	
				SGPED40-07-RO	GFR0100UZ	100.00	1.645E+13	9.035E+12							-0.020	-0.154	-0.004	-0.011	-0.012	-0.008	0.022	
				SGPED40-08-RO	GFR0100V0	120.00	8.368E+12	4.286E+12							-0.027	-0.059	0.016	0.015	0.013	0.011	-0.026	
SGPED40-09-RO	GFR0100V1	140.00	4.605E+12	3.310E+12							-0.005	-0.001	0.005	0.001	0.017	0.004	-0.005					
SGPED40-10-RO	GFR0100V2	160.00	4.292E+12	4.092E+12							-0.005	-0.010	0.000	0.003	-0.003	-0.005	0.000					
SGPED40-11-RO	GFR0100CR																					
SGPED50	29.75794	71.16618	652	SGPED50-01-RO		5.00	2.360E+11	7.153E+11							-0.032		-0.057	-0.047	-0.087	-0.024	0.047	
				SGPED50-02-RO		11.25	2.326E+11	1.106E+12							-0.033		-0.004	-0.011	0.005	0.014	0.002	
				SGPED50-03-RO		22.50	1.086E+12	2.415E+13							0.011		0.004	0.004	-0.004	0.001	-0.002	
				SGPED50-04-RO		40.00	1.813E+13	1.896E+13		0.273	-0.230	-0.043			-0.043		0.012	0.025	0.012	0.020	0.012	-0.013
				SGPED50-05-RO		60.00	1.621E+13	1.529E+13		0.004	0.077	-0.081			0.002		0.007	0.004	-0.002	0.015	-0.002	
				SGPED50-06-RO		80.00	1.075E+13	9.063E+12		0.024	0.049	-0.074			-0.017		-0.020	-0.010	-0.025	-0.024	0.013	
				SGPED50-07-RO		100.00	8.193E+12	4.970E+12							0.004		0.001	0.001	0.017	-0.001	-0.004	
				SGPED50-08-RO		120.00	3.984E+12	3.618E+12							-0.016		-0.001	-0.002	0.002	0.000	0.000	
SGPED50-09-RO		140.00	2.609E+12	3.750E+12							0.038		-0.006	-0.003	-0.006	-0.001	0.003					
SGPED50-10-RO		160.00	1.815E+12	4.579E+12							0.006		-0.023	0.005	-0.001	-0.008	0.001					
SGPED50-11-RO																						
SGPED60	29.75826	71.16615	638	SGPED60-01-RO	GFR0100V4	5.00	2.417E+11	1.053E+12	-0.012	0.397	-0.392	-0.005	0.002	-0.621	-0.072	0.078	0.006	0.015	0.012	-0.006	-0.016	0.020
				SGPED60-02-RO	GFR0100V5	11.25	2.048E+11	9.327E+11	-0.002	0.532	0.358	0.173	0.008	0.035	0.124	-0.033	-0.006	-0.011	-0.013	0.010	0.011	-0.011
				SGPED60-03-RO	GFR0100V6	22.50	9.275E+11	1.961E+13	0.001	0.174	-0.204	0.030	-0.041	-0.013	-0.057	0.038	0.000	0.001	0.003	-0.002	-0.003	0.003
				SGPED60-04-RO	GFR0100V7	40.00	1.561E+13	1.674E+13	-0.002	-0.230	0.104	0.126	-0.004	1.441	-0.012	0.014	0.003	0.005	0.006	-0.001	-0.005	0.007
				SGPED60-05-RO	GFR0100V8	60.00	1.324E+13	1.052E+13		0.606	-0.378	-0.228	0.002	0.629	0.002	0.023	0.011	0.008	0.002	0.008	-0.005	
				SGPED60-06-RO	GFR0100V9	80.00	6.252E+12	8.791E+12							0.002	0.052	-0.005	-0.002	0.006	-0.003	-0.001	
				SGPED60-07-RO	GFR0100VA	100.00	7.410E+12	6.552E+12							-0.006	0.009	0.001	0.004	0.013	-0.007	-0.005	
				SGPED60-08-RO	GFR0100VB	120.00	5.418E+12	3.899E+12							-0.001	-0.024	-0.004	-0.006	0.002	0.001	0.003	
SGPED60-09-RO	GFR0100VC	140.00	3.666E+12	3.521E+12							-0.007	-0.032	0.005	0.003	-0.013	0.002	0.004					
SGPED60-10-RO	GFR0100VD	160.00	3.018E+12	4.761E+12							-0.007	0.005	-0.005	-0.007	-0.006	0.002	0.004					
SGPED60-11-RO	GFR0100VE																					
SGPED70	29.76120	71.16559	690	SGPED70-01-RO	GFR0100VF	5.00	3.942E+11	5.722E+11	0.016				-1.242	1.890	0.008	0.216	0.019	0.047	0.026	0.022	-0.055	0.040
				SGPED70-02-RO	GFR0100VG	11.25	2.459E+11	8.420E+11	0.004				0.769	-11.256	-0.005	0.150	0.004	0.002	0.010	0.010	-0.011	0.013
				SGPED70-03-RO	GFR0100VH	22.50	6.988E+11	2.272E+13	0.000				-0.385	0.000	0.020	0.053	-0.001	-0.004	-0.001	0.003	0.001	-0.007
				SGPED70-04-RO	GFR0100VJ	40.00	1.285E+13	1.877E+13							0.003	-0.115	0.008	0.005	0.002	0.010	-0.003	
				SGPED70-05-RO	GFR0100VK	60.00	1.206E+13	7.211E+12							-0.065	-0.051	-0.001	0.001	0.007	0.000	-0.001	
				SGPED70-06-RO	GFR0100VL	80.00	4.538E+12	2.108E+12							0.011	-0.002	0.009	0.010	0.003	0.012	-0.008	
				SGPED70-07-RO	GFR0100VM	100.00	1.711E+12	2.703E+12							-0.004	-0.086	-0.011	-0.015	-0.003	-0.009	0.011	
				SGPED70-08-RO	GFR0100VN	120.00	1.197E+12	3.197E+12							0.011	-0.021	0.001	0.004	0.005	0.002	0.002	
SGPED70-09-RO	GFR0100VP	140.00	1.148E+12	3.930E+12							-0.005	-0.022	0.008	0.006	0.000	0.009	-0.004					
SGPED70-10-RO	GFR0100VQ	160.00	1.278E+12	4.897E+12							0.013	0.030	-0.008	-0.006	-0.001	-0.009	0.004					
SGPED70-11-RO	GFR0100VR																					
<div><div>(1) Average of envelope signal over soil depth from this study</div><div>(2) Bulk density from Barnhardt et al., 2018</div><div>(3) Grain size distribution from Barnhardt et al., 2018</div><div>(4) pH from Barnhardt et al., 2018</div><div>(5) Cation exchange capacity from Barnhardt et al., 2018</div><div>(6) Loss on Ignition LOI from Oesser et al., 2018</div><div>(7) Chemical Index of Alteration CIA calculated based on data from Oesser et al., 2018</div><div>(8) Mass transfer coefficient Tau calculated based on data from Oesser et al., 2018</div><div>(9) Volumetric strain calculated based on data from Oesser et al., 2018</div></div>																						

Table S2C: Data compilation for regolith profiles																						
Soil profile	Location °S °W	Altitude m	Sample	IGSN	Depth cm	GPR 500 ⁽¹⁾ MHz	GPR 1000 ⁽¹⁾ MHz	Bulk density ⁽²⁾	sand %	Grain size ⁽³⁾ silt %	clay %	pH ⁽⁴⁾	CEC ⁽⁵⁾ µmol/g	LOI ⁽⁶⁾	CIA ⁽⁷⁾	Ca	Na	Tau ⁽⁸⁾	Mg	Zr	Vol. strain ⁽⁹⁾	
La Campana																						
LCPED10	32 95581	71 06332	734 LCPED10-01-RO	GFRD10021	5.00	3.57E+11	8.02E+11	0.019	0.342	-0.160	-0.182	-0.028	-30.399	-1.872	0.383	-0.096	0.003	-0.002	-0.007	0.006	-0.007	
			LCPED10-02-RO	GFRD10022	11.25	3.71E+11	1.48E+12	-0.004	0.009	-0.067	0.058	-0.037	-5.507	-0.185	0.098	-0.017	0.002	0.003	0.000	-0.008	-0.001	
			LCPED10-03-RO	GFRD10023	22.50	1.70E+12	4.37E+13	0.011	0.132	-0.167	0.035	-0.025	-0.769	-0.055	0.103	-0.023	0.005	0.008	-0.007	-0.016	0.004	
			LCPED10-04-RO	GFRD10024	40.00	2.53E+13	2.80E+13	0.009	0.193	-0.186	-0.007	-0.022	-0.482	0.008	0.089	-0.028	0.006	0.012	-0.010	-0.018	0.007	
			LCPED10-05-RO	GFRD100V5	60.00	1.74E+13	2.53E+13	-0.001	0.251	-0.130	-0.122	-0.008	-0.133	0.014	-0.009	-0.028	0.011	0.011	-0.016	-0.009	0.008	
			LCPED10-06-RO	GFRD100VT																		
LCPED20	32 95588	71 06355	718 LCPED20-01-RO	GFRD10029	5.00	4.13E+11	1.41E+12	0.079	0.297	-0.127	-0.170	-0.042	46.737	-1.922	0.500	-0.072	-0.001	-0.012	-0.016	0.014	-0.004	
			LCPED20-02-RO	GFRD1002A	11.25	2.81E+11	9.96E+11	0.025	0.098	-0.184	0.085	-0.004	-16.491	-0.192	0.160	-0.002	0.006	0.006	0.014	-0.005	-0.034	
			LCPED20-03-RO	GFRD1002B	22.50	7.48E+11	2.20E+13	0.002	0.006	-0.071	0.065	-0.017	-2.093	-0.003	-0.003	0.004	0.003	0.002	0.011	-0.003	0.005	
			LCPED20-04-RO	GFRD1002C	40.00	1.52E+13	2.67E+13	0.007	0.053	0.024	-0.077	-0.009	-0.463	0.020	-0.019	-0.005	-0.007	-0.006	-0.005	0.009	-0.016	
			LCPED20-05-RO	GFRD1002D	60.00	1.95E+13	1.46E+13	0.004	0.340	-0.158	-0.182	-0.002	-0.779	-0.079	-0.053	0.037	0.020	0.013	0.062	-0.018	0.015	
			LCPED20-06-RO	GFRD100VU	80.00	2.49E+13	1.92E+13	0.002	0.056	-0.124	0.068	-0.010	-0.348	-0.041	0.022	-0.009	-0.003	0.000	-0.019	0.001	-0.003	
			LCPED20-07-RO	GFRD100VV	100.00	1.57E+13	7.44E+12	-0.003	0.088	0.036	-0.124	0.000	0.022	0.038	-0.022	-0.014	-0.007	-0.007	-0.024	0.007	-0.006	
			LCPED20-08-RO	GFRD100VW	120.00	5.60E+12	6.63E+12	0.003	0.116	-0.153	0.037	-0.006	-0.888	-0.068	0.001	-0.011	-0.004	-0.002	-0.027	0.005	-0.006	
			LCPED20-09-RO	GFRD100VY	140.00	4.58E+12	6.64E+12	-0.005	-0.123	0.110	0.013	0.016	-0.176	-0.017	-0.045	0.001	0.004	0.008	-0.006	-0.004	0.006	
			LCPED20-10-RO	GFRD100VX																		
LCPED30	32 95615	71 06380	708 LCPED30-01-RO	GFRD1002Q	5.00	3.55E+11	1.02E+12	0.030	-0.349	0.260	0.089	-0.036	-10.027	-1.280	-0.158	0.016	-0.003	-0.002	0.001	0.001	-0.019	
			LCPED30-02-RO	GFRD1002R	11.25	3.09E+11	9.43E+11	-0.009	0.588	-0.307	-0.282	0.005	-14.262	0.144	0.151	-0.028	-0.002	-0.012	0.003	0.015	-0.013	
			LCPED30-03-RO	GFRD1002S	22.50	1.11E+12	2.34E+13	-0.010	0.050	-0.073	0.023	-0.001	-1.143	-0.003	-0.008	0.007	0.005	0.003	0.011	-0.007	0.009	
			LCPED30-04-RO	GFRD1002T	40.00	1.72E+13	2.40E+13	0.003	0.137	-0.081	-0.056	-0.004	-0.296	0.030	-0.056	0.011	0.009	0.004	0.012	-0.007	0.015	
			LCPED30-05-RO	GFRD1002U	60.00	1.43E+13	1.75E+13	0.011	-3.828	-0.719	-0.453	-0.292	-0.928	-0.076	-0.054	0.007	0.006	0.003	0.000	-0.004	-0.007	
			LCPED30-06-RO	GFRD100VZ	80.00	9.84E+12	1.19E+13	0.012	4.538	0.309	0.153	0.299	-1.185	0.096	-0.038	0.018	0.014	0.007	0.018	-0.008	0.002	
			LCPED30-07-RO	GFRD100W0	100.00	6.52E+12	6.39E+12	0.005	0.007	0.002	-0.008	-0.002	0.531	-0.130	-0.008	-0.011	-0.008	-0.010	-0.011	0.006	-0.014	
			LCPED30-08-RO	GFRD100W1	120.00	4.40E+12	5.29E+12	0.005	-0.103	0.041	0.062	-0.010	0.648	0.006	0.013	-0.004	-0.001	0.004	-0.009	0.000	-0.003	
			LCPED30-09-RO	GFRD100W2	140.00	3.87E+12	6.08E+12	-0.002	0.075	-0.081	0.007	0.004	-0.307	0.006	0.006	0.009	0.005	0.002	0.015	-0.004	0.008	
			LCPED30-10-RO	GFRD100W3	160.00	2.75E+12	5.87E+12	-0.003	0.050	0.104	-0.053	-0.009	-0.082	-0.008	0.024	-0.001	0.003	0.006	-0.010	-0.002	0.005	
			LCPED30-11-RO	GFRD100W4	180.00	3.12E+12	7.14E+12	-0.005	0.132	-0.085	-0.047	0.003	-0.278	0.012	-0.018	-0.019	-0.016	-0.015	-0.011	0.014	-0.015	
			LCPED30-12-RO	GFRD100W5	200.00	3.76E+12	7.18E+12	0.002	0.056	-0.013	-0.043	0.004	0.320	-0.014	-0.021	-0.009	-0.008	-0.005	-0.012	0.011	-0.011	
			LCPED30-13-RO	GFRD100W6	220.00	3.55E+12	4.97E+12	0.000	0.018	-0.027	0.008	-0.001	-0.346	-0.010	0.000	0.021	0.018	0.009	0.023	-0.018	0.018	
			LCPED30-14-RO	GFRD100W7	240.00	1.96E+12	4.97E+12	-0.001	-0.097	0.082	0.015	-0.006	-0.218	0.008	0.011	-0.001	-0.002	-0.001	0.001	0.001	0.000	
			LCPED30-15-RO	GFRD100W8	260.00			-0.004	0.013	-0.050	0.037	-0.003	0.050	0.010	0.030	0.007	0.007	0.008	0.011	-0.006	0.012	
			LCPED30-16-RO	GFRD100W8	280.00			0.004	-0.087	0.136	-0.049	-0.013	0.002	-0.016	-0.017	-0.019	-0.016	-0.008	-0.020	0.013	-0.020	
			LCPED30-17-RO	GFRD100W9	300.00			-0.002	-0.013	-0.018	0.030	0.006	-0.116	0.008	-0.001	0.019	0.020	-0.001	0.015	-0.012	0.017	
			LCPED30-18-RO	GFRD100W8	320.00			0.003	0.091	-0.097	0.006	0.002	0.202	0.001	0.003	-0.027	-0.024	-0.002	-0.025	0.016	-0.021	
			LCPED30-19-RO	GFRD100WC	340.00			0.003	-0.023	0.000	0.024	-0.006	-0.097	-0.010	0.041	-0.005	0.005	0.015	-0.016	-0.010	0.000	
			LCPED30-20-RO	GFRD100WD																		
LCPED40	32 95720	71 06425	724 LCPED40-01-LMM	GFRD1002V	5.00	4.72E+11	1.46E+12	0.009	0.067	0.110	-0.177	-0.074	-19.974	-1.134	0.139	-0.021	-0.002	0.000	-0.014	0.011	-0.018	
			LCPED40-02-LMM	GFRD1002V	11.25	3.20E+11	9.52E+11	0.022	0.070	-0.228	0.158	-0.041	-2.298	-0.117	0.250	0.010	0.011	0.012	0.025	-0.035	0.006	
			LCPED40-03-LMM	GFRD1002X	22.50	1.06E+12	1.98E+13	0.002	-0.208	0.018	0.190	-0.009	0.232	-0.006	0.066	0.004	0.004	0.006	0.007	-0.013	0.006	
			LCPED40-04-LMM	GFRD1002Y	40.00	1.22E+13	1.85E+13	0.000	-0.064	-0.015	0.080	0.006	0.116	-0.018	-0.021	0.001	0.002	0.006	0.002	-0.004	0.004	
			LCPED40-05-LMM	GFRD1002Z	60.00	1.74E+13	2.16E+13	0.003	0.003	0.021	-0.024	-0.004	0.110	0.010	0.084	0.001	0.002	0.006	0.002	-0.007	0.002	
			LCPED40-06-LMM	GFRD10030	80.00	2.23E+13	8.83E+12	0.005	0.024	-0.054	0.030	0.003	0.095	0.015	0.014	-0.003	-0.003	-0.007	-0.004	0.005	-0.006	
			LCPED40-07-LMM	GFRD100W0	100.00	1.34E+13	3.33E+12	-0.010	0.278	-0.109	-0.169	0.000	-1.448	-0.040	-0.097	0.000	0.002	-0.002	-0.007	0.002	0.003	
			LCPED40-08-LMM	GFRD100WF	120.00	1.00E+13	3.20E+12	-0.003	0.710	-0.391	-0.319	0.015	-0.960	-0.048	-0.206	0.013	0.014	0.010	0.003	-0.010	0.010	
LCPED40-09-LMM	GFRD100WE																					
⁽¹⁾ Average of envelope signal over soil depth from this study ⁽²⁾ Bulk density from Bernhard et al., 2018 ⁽³⁾ Grain size distribution from Bernhard et al., 2018 ⁽⁴⁾ pH from Bernhard et al., 2018 ⁽⁵⁾ Cation exchange capacity from Bernhard et al., 2018 ⁽⁶⁾ Loss on ignition LOI from Oester et al., 2018 ⁽⁷⁾ Chemical Index of Alteration CIA calculated based on data from Oester et al., 2018 ⁽⁸⁾ Mass transfer coefficient Tau calculated based on data from Oester et al., 2018 ⁽⁹⁾ Volumetric strain calculated based on data from Oester et al., 2018																						

⁽¹⁾ Average of envelope signal over soil depth from this study

⁽²⁾ Bulk density from Bernhard et al., 2018

⁽³⁾ Grain size distribution from Bernhard et al., 2018

⁽⁴⁾ pH from Bernhard et al., 2018

⁽⁵⁾ Cation exchange capacity from Bernhard et al., 2018

⁽⁶⁾ Loss on ignition LOI from Oeser et al., 2018

⁽⁷⁾ Chemical Index of Alteration CIA calculated based on data from Oeser et al., 2018

⁽⁸⁾ Mass transfer coefficient[†] Tau calculated based on data from Oeser et al., 2018

⁽⁹⁾ Volumetric strain calculated based on data from Oeser et al., 2018

Table S2D: Data compilation for regolith profiles

Average of envelope signal over soil depth from this study									
^(a)	Bulk density from Bernhard et al., 2018								
^(b)	Grain size distribution from Bernhard et al., 2018								
^(c)	pH from Bernhard et al., 2018								
^(d)	Cation exchange capacity from Bernhard et al., 2018								
^(e)	Loss on ignition LOI from Deser et al., 2018								
^(f)	Chemical Index of Alteration CIA calculated based on data from Deser et al., 2018								
^(g)	Mass transfer coefficient T_m calculated based on data from Deser et al., 2018								
^(h)	Volumetric strain calculated based on data from Deser et al., 2018								

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Table S3: Correlation coefficients R of 1000 and 500 MHz GPR envelope with derivatives of physical and chemical properties for each study area										
Study area		Bulk density	Clay content	pH	CEC	LOI	CIA	Tau		Vol. strain
								Na	Zr	
1000 MHz										
Pan de Azucar	GPR	0.05	0.54			-0.1	-0.2	-0.1	-0.15	
Santa Gracia	GPR	-0.03	0.3			0.14	0.33	-0.16	0.1	
La Campana	GPR	-0.04	0.19	-0.34	-0.35	-0.19	0.43	-0.12	0.07	-0.18
Nahuelbuta	GPR									
Earth Shape	GPR	0.01	0.25	-0.15	-0.24	0.02	0	-0.14	0.01	
500 MHz										
Pan de Azucar	GPR	-0.29	0.17			-0.27	0.28	0.16	-0.07	
Santa Gracia	GPR	-0.39	0.26			-0.02	0.26	-0.08	0.02	
La Campana	GPR	0.2	0.22	-0.57	-0.39	-0.26	0.56	0.09	-0.26	-0.12
Nahuelbuta	GPR	0.74	-0.37	0.46	-0.53	-0.60	-0.24	0.21	-0.28	-0.01
Earth Shape	GPR	-0.16	-0.02	-0.39	-0.45	-0.03	0.45	0.11	-0.15	

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TableS4 A to E

Table S4A: Primary component analysis for physical and chemical properties in Pan de Azucar								
Parameter	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
	%	%	%	%	%	%	%	%
Bulk sensity	5	7	34	39	1	12	2	0
Clay	20	0	14	4	30	4	0	27
LOI	4	30	9	12	5	28	2	10
CIA	17	1	29	6	2	41	0	4
Tau Na	13	21	3	0	7	2	8	45
Tau Zr	9	18	0	30	5	9	28	1
Envelope 500 MHz	22	2	2	0	48	0	25	2
Envelope 1000 MHz	10	21	8	9	2	4	35	10

Table S4B: Primary component analysis for physical and chemical properties in Santa Gracia								
Parameter	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
	%	%	%	%	%	%	%	%
Bulk sensity	17	0	3	67	7	2	3	0
Clay	1	15	38	1	8	34	3	0
LOI	11	16	0	17	41	1	12	1
CIA	16	2	27	7	7	31	8	2
Tau Na	2	31	10	5	1	0	5	45
Tau Zr	1	36	4	1	0	8	1	49
Envelope 500 MHz	29	0	4	0	0	24	40	2
Envelope 1000 MHz	22	0	14	0	35	0	28	0

Table S4C: Primary component analysis for physical and chemical properties in La Campana											
Parameter	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11
	%	%	%	%	%	%	%	%	%	%	%
Bulk sensinty	14	0	13	4	15	19	17	1	1	10	6
Clay	9	7	8	7	35	5	2	0	16	4	7
LOI	17	1	6	0	15	19	9	10	15	7	0
CIA	0	25	2	7	1	1	0	37	26	0	3
Tau Na	17	7	4	0	2	2	2	9	0	51	6
Tau Zr	15	2	17	8	1	1	5	1	2	2	46
pH	1	14	28	0	1	4	1	0	10	19	21
CEC	4	16	1	14	27	2	3	23	0	0	11
Volumetric strain	19	3	2	3	2	13	4	17	29	7	1
Envelope 500 MHz	4	12	12	2	2	34	31	1	1	0	0
Envelope 1000 MHz	1	11	5	55	0	0	26	1	1	0	0

Table S4D: Primary component analysis for physical and chemical properties in Nahuelbuta											
Parameter	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	
	%	%	%	%	%	%	%	%	%	%	
Bulk sensinty	13	4	4	1	0	10	62	5	0	0	
Clay	13	0	2	3	33	5	2	32	11	0	
LOI	15	3	0	1	3	0	12	13	0	53	
CIA	6	0	54	26	11	0	0	2	0	0	
Tau Na	9	14	1	7	1	59	5	3	0	1	
Tau Zr	8	23	3	3	8	10	0	5	33	8	
pH	1	47	5	0	11	3	2	0	26	5	
CEC	12	0	2	27	21	10	2	16	11	1	
Volumetric strain	14	4	0	10	0	2	3	16	19	31	
Envelope 500 MHz	8	5	29	21	13	1	13	9	0	1	

Table S4E: Primary component analysis for physical and chemical parameters in the climate gradient											
Parameter	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	
	%	%	%	%	%	%	%	%	%	%	
Bulk sensinty	17	2	7	0	18	30	24	0	2	0	
Clay	8	6	1	32	29	6	0	0	7	11	
LOI	19	1	17	2	3	10	3	8	36	0	
CIA	0	29	1	9	7	1	2	33	17	0	
Tau Na	15	2	27	1	2	0	1	1	2	49	
Tau Zr	12	0	32	9	3	5	0	0	1	38	
pH	2	22	4	22	3	1	0	43	4	1	
CEC	22	0	9	3	1	15	4	13	31	1	
Envelope 500 MHz	4	20	0	11	1	31	32	0	0	0	
Envelope 1000 MHz	1	18	3	10	33	1	32	1	0	1	