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Discriminant model and hydrogeochemical processes for characterizing preferential flow paths in four interconnected volcanic aquifers in Costa Rica

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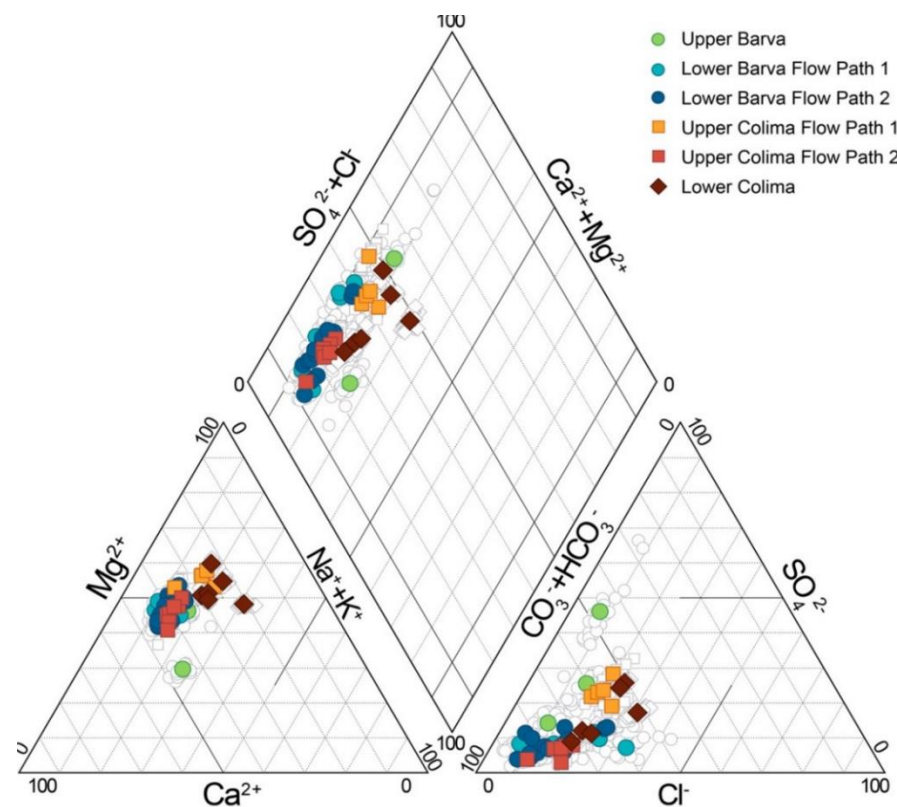


Fig. S1. Piper diagram and hydrochemical facies of all samples and their median values in sampling sites for Barva and Colima flow paths.

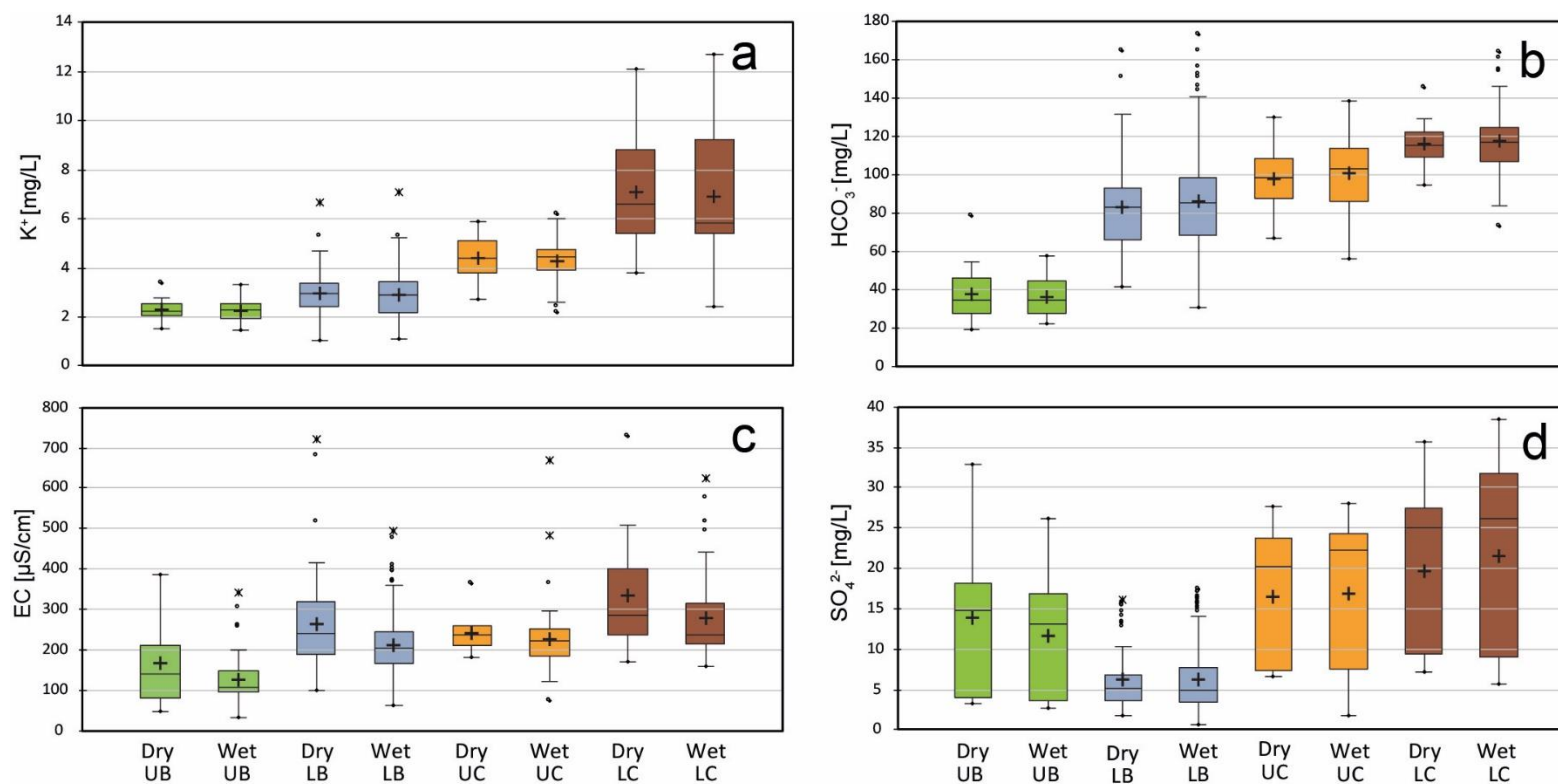


Fig. S2. Box plots showing the maximum, minimum, median, and mean values and interquartile ranges for (a) potassium, (b) bicarbonate, (c) electrical conductivity (EC), and (d) sulfate for dry and wet seasons in Upper Barva (UB), Lower Barva (LB), Upper Colima (UC) and, Lower Colima (LC).

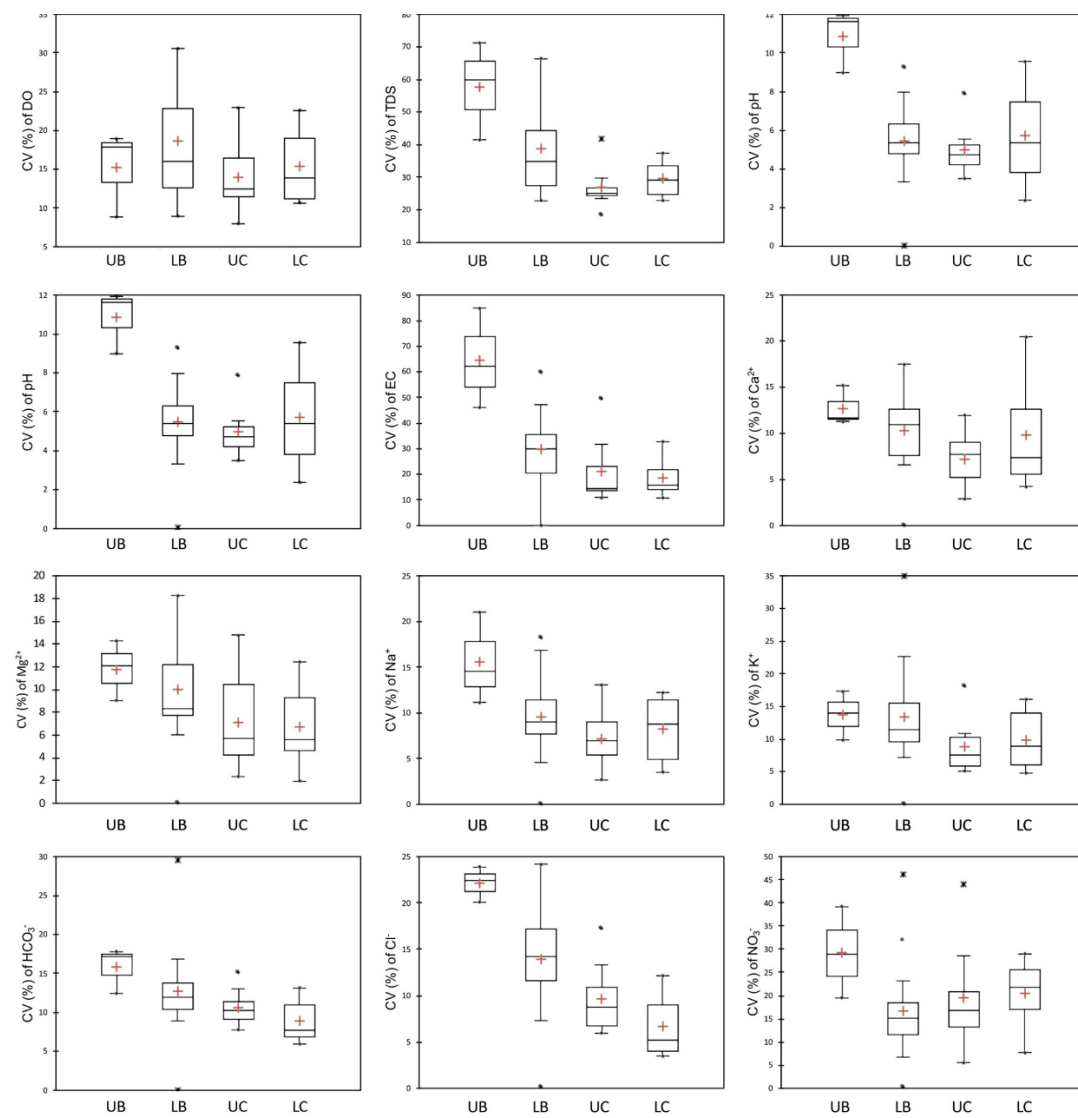


Fig. S3. Box plots for the coefficient of variation (CV) for physical and chemical values within each sampling site in Upper Barva (UB), Lower Barva (LB), Upper Colima (UC) and Lower Colima (LB).

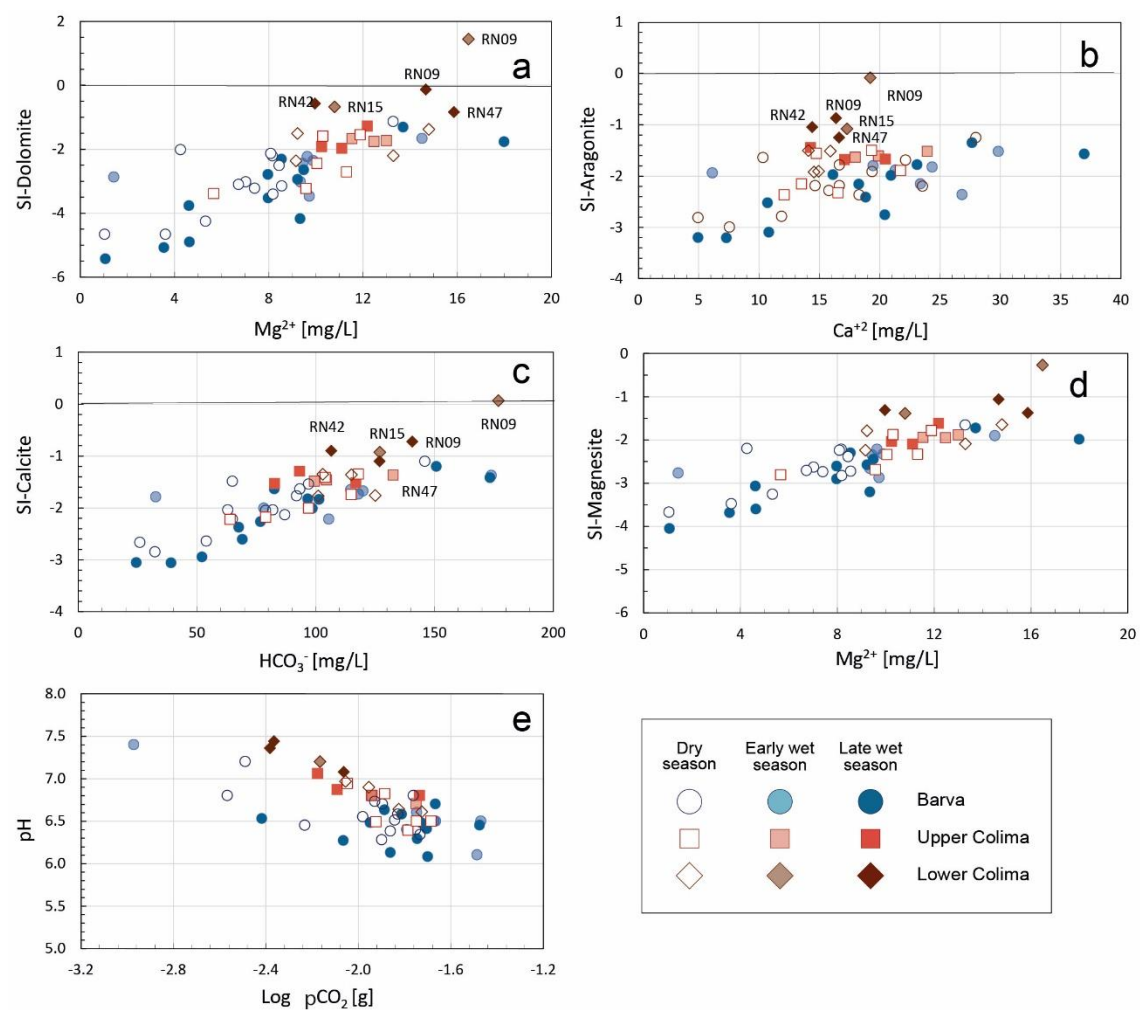


Fig. S4. Relations of (a) magnesium vs. SI-dolomite (b) calcium vs. SI-aragonite, (c) bicarbonate vs. SI-calcite, (d) magnesium vs. SI-magnesite, and (e) $\text{Log } pCO_2$ vs. pH in groundwater samples in Barva and Colima flow paths. Dry season refers to March's survey, early wet season to June's survey, and late wet season to January's survey.

Table S1. Composition of the rocks in Barva, Tiribí, and Colima Formations.

Mineral	Aprox. Formula	Los Ángeles Member ¹	Los Bambinos Member ²	Bermúdez Member ^{3, 4}	Tiribí Formation (Upper Sheet) ⁵	Upper Colima Member ³	Lower Colima Member ³
Phenocrystals (%)		21 - 41	30 - 40	3 - 49		2 - 4	16 - 38
Plagioclase (%)	NaAl ₂ Si ₂ O ₈ and CaAl ₂ Si ₂ O ₈	12 - 22	25 - 35	4 - 35	1-10	1.5 - 3	12 - 30
Anorthite (% An)	CaAl ₂ Si ₂ O ₈			44 - 80	34-76		48 - 75
Pyroxenes			< 5				
Clinopyroxene (Augite)	Ca(Mg,Fe)Si ₂ O ₆			0 - 9	<1-5	+	1 - 6
Orthopyroxene (Hypersthene)	(MgFe)SiO ₆	1 - 6		0 - 8	0-1	+	0.5 - 3
Olivine	(MgFe)SiO ₄	0.5- 1.2	< 1	0 - 9	+	+	0 - 5
Glass					67- 97		
Matrix (%)		42 - 75.6					
Vesicle (%)		12 - 33					

¹ Rojas et al. (2017), ² Arredondo & Soto (2007), ³ Kussmaul (1988), ⁴ Fonseca et al. (2015), ⁵ Pérez et al (2006).

Table S2. Descriptive statistics of physical and chemical parameters per sampling site in Barva and Colima multi-aquifer system.

Site code	Statistic	ORP [mV]	DO [mg/L]	TDS [ppm]	T [°C]	pH	EC [µS/cm]	Ca ²⁺ [mg/L]	Mg ²⁺ [mg/L]	Na ⁺ [mg/L]	K ⁺ [mg/L]	HCO ₃ ⁻ [mg/L]	Cl ⁻ [mg/L]	SO ₄ ²⁻ [mg/L]	NO ₃ ⁻ [mg/L]
<i>Upper Barva</i>															
RN02	Min	123	6.6	11	15.5	5.4	33	4.6	1.1	2.8	1.6	24.9	0.9	2.7	0.9
	Max	267	8.9	88	18.8	7.8	198	6.8	1.5	4.0	2.3	35.5	2.0	4.1	2.0
	Mean	187	7.9	32	16.5	6.8	80	5.7	1.3	3.4	2.0	29.3	1.4	3.5	1.6
	SD	45	0.7	23	0.9	0.8	68	0.6	0.1	0.4	0.2	3.6	0.3	0.4	0.3
	CV (%)	0.2	8.9	71.2	5.4	11.9	84.9	11.3	9.0	11.2	9.9	12.4	23.9	12.1	19.5
	S-W Statistic	0.99	0.96	0.88	0.93	0.82	0.90	0.94	0.90	0.88	0.93	0.87	0.93	0.92	0.77
	S-W p-value	0.974	0.804	0.325	0.607	0.127	0.412	0.664	0.422	0.332	0.571	0.275	0.569	0.533	0.042
RN03	Min	105	4.6	37	18.2	5.2	50	4.5	2.2	2.8	1.6	19.2	1.2	9.6	0.8
	Max	395	9.1	199	22.0	7.8	385	10.9	5.0	6.1	3.4	39.7	2.9	32.9	6.6
	Mean	212	7.5	68	18.8	6.6	141	8.4	4.0	4.8	2.6	32.3	1.9	19.8	3.6
	SD	79	1.3	41	0.9	0.8	88	1.3	0.6	0.7	0.4	5.7	0.4	5.2	1.4
	CV (%)	37.1	17.8	59.8	4.7	11.6	62.3	15.2	14.3	14.6	13.9	17.8	20.1	26.4	39.1
	S-W Statistic	0.94	0.89	0.93	0.93	0.93	0.90	0.93	0.94	0.91	0.87	0.92	0.96	0.97	0.89
	S-W p-value	0.676	0.279	0.526	0.553	0.532	0.349	0.510	0.668	0.374	0.176	0.474	0.818	0.889	0.272
RN23	Min	128	4.1	49	19.7	5.4	90	9.8	3.9	3.9	1.5	40.6	2.9	8.5	1.4
	Max	436	9.1	174	26.2	7.3	341	15.5	6.4	9.2	2.9	78.6	7.0	19.5	15.3
	Mean	238	6.9	88	21.5	6.4	168	12.3	5.2	5.5	2.3	51.9	4.2	13.3	10.5
	SD	83	1.3	37	1.5	0.6	77	1.4	0.6	1.2	0.4	8.9	0.9	2.8	3.0
	CV (%)	35.0	18.9	41.5	7.2	9.0	46.1	11.7	12.1	21.0	17.3	17.1	22.5	21.2	29.0
	S-W Statistic	0.85	0.78	0.81	0.94	0.78	0.80	0.99	0.96	0.81	0.93	0.89	0.74	0.96	0.91
	S-W p-value	0.122	0.029	0.057	0.637	0.026	0.039	0.988	0.854	0.053	0.521	0.277	0.010	0.820	0.414
<i>Lower Barva</i>															
RN01	Min	86	5.6	16	16.6	5.8	70	4.6	1.3	3.6	1.6	34.5	1.1	2.0	0.3
	Max	372	9.6	190	19.5	7.3	350	13.2	5.3	7.2	3.0	84.4	3.3	5.6	3.2
	Mean	211	7.5	77	17.5	6.6	166	10.5	4.4	5.3	2.6	66.1	1.6	3.7	1.9
	SD	107	1.4	48	0.9	0.5	100	2.7	1.2	0.9	0.3	14.2	0.6	0.9	0.7
	CV (%)	50.5	18.0	63.2	5.0	6.8	60.6	25.4	27.4	16.6	13.2	21.5	37.3	23.8	39.2
	S-W Statistic	1.00	0.95	0.98	0.96	0.96	0.83	1.00	0.86	0.86	0.83	0.96	0.86	1.00	0.96
	S-W p-value	0.997	0.550	0.747	0.637	0.637	0.183	0.946	0.277	0.262	0.180	0.614	0.276	0.930	0.637

EC electrical conductivity; T temperature; DO dissolved oxygen; ORP oxidation-reduction potential; TDS total dissolved solids.

Values in bold show variables with a significantly non-normal distribution at a p-value < 0.05

Site code	Statistic	ORP [mV]	DO [mg/L]	TDS [ppm]	T [°C]	pH	EC [µS/cm]	Ca ²⁺ [mg/L]	Mg ²⁺ [mg/L]	Na ⁺ [mg/L]	K ⁺ [mg/L]	HCO ₃ ⁻ [mg/L]	Cl ⁻ [mg/L]	SO ₄ ²⁻ [mg/L]	NO ₃ ⁻ [mg/L]
RN06	Min	118	3.2	37	20.5	5.5	80	10.3	5.3	3.8	1.6	58.8	2.8	1.7	9.3
	Max	386	7.9	234	23.3	7.7	494	20.5	10.3	6.5	5.2	119.0	6.7	3.5	22.3
	Mean	215	6.7	104	21.4	6.5	210	16.1	7.8	5.3	3.0	85.2	4.0	2.8	14.8
	SD	84	1.3	45	0.8	0.5	99	2.4	1.2	0.7	0.7	14.4	0.8	0.4	2.6
	CV (%)	39.2	19.9	43.8	4.0	8.0	47.2	15.0	15.3	13.0	22.6	16.8	18.8	13.9	17.9
	S-W Statistic	0.93	0.72	0.89	0.83	0.96	0.86	0.87	0.75	0.94	0.63	0.88	0.57	0.82	0.84
	S-W p-value	0.576	0.006	0.253	0.087	0.787	0.158	0.184	0.013	0.597	0.001	0.237	0.000	0.065	0.107
RN08	Min	64	3.1	68	20.7	5.8	120	14.5	5.6	4.3	1.8	47.7	3.1	2.7	26.4
	Max	231	9.0	152	24.1	7.0	308	19.2	8.0	5.1	3.1	75.4	5.7	5.2	51.2
	Mean	121	5.9	101	22.2	6.4	197	17.5	6.8	4.8	2.1	59.2	4.0	4.0	38.9
	SD	57	1.6	23	0.9	0.4	50	1.3	0.6	0.2	0.3	7.7	0.6	0.8	7.2
	CV (%)	47.1	26.8	22.8	4.1	5.6	25.4	7.6	8.1	4.6	13.9	13.0	14.2	20.5	18.5
	S-W Statistic	0.74	0.95	0.92	0.85	0.98	0.87	0.93	0.86	0.84	0.86	0.82	0.69	0.88	0.95
	S-W p-value	0.024	0.764	0.530	0.209	0.950	0.268	0.612	0.228	0.153	0.214	0.112	0.008	0.314	0.733
RN12	Min	120	4.5	32	20.9	5.6	140	9.9	7.3	6.2	2.6	76.5	4.9	3.5	9.1
	Max	325	7.2	247	22.3	7.2	401	19.5	9.6	8.9	4.6	110.4	7.4	6.3	20.6
	Mean	213	6.0	123	21.8	6.5	227	17.2	8.5	7.0	3.1	93.3	5.4	5.2	16.3
	SD	58	0.7	52	0.4	0.4	81	2.1	0.5	0.7	0.4	10.0	0.6	0.6	2.1
	CV (%)	27.3	12.3	41.7	1.9	6.3	35.6	12.1	6.0	9.4	13.6	10.7	11.6	11.6	12.8
	S-W Statistic	0.97	0.86	0.90	0.88	0.94	0.87	0.96	0.91	0.85	0.94	0.91	0.91	0.77	0.93
	S-W p-value	0.914	0.205	0.381	0.290	0.669	0.227	0.787	0.461	0.173	0.694	0.467	0.424	0.030	0.591
RN13	Min	212	5.1	99	22.2	5.8	171	22.9	7.9	7.9	3.5	86.5	11.3	9.6	32.5
	Max	482	8.1	309	24.8	7.0	641	33.8	11.8	12.4	6.6	126.5	16.8	15.7	52.1
	Mean	271	6.4	184	22.8	6.3	315	28.6	9.8	9.7	4.5	101.1	13.9	12.3	38.7
	SD	81	1.0	67	0.7	0.3	121	2.3	0.8	1.1	0.7	12.1	1.5	1.5	4.1
	CV (%)	30.1	15.7	36.2	2.9	5.1	38.6	8.2	8.2	11.5	15.2	12.0	10.9	12.5	10.7
	S-W Statistic	0.84	0.90	0.95	0.80	0.93	0.95	0.79	0.81	0.88	0.90	0.86	0.95	0.95	0.94
	S-W p-value	0.135	0.395	0.724	0.057	0.599	0.725	0.051	0.071	0.273	0.350	0.206	0.772	0.703	0.642
RN17	Min	166	3.1	85	24.2	5.7	224	21.2	9.5	8.6	3.2	102.3	7.2	10.0	20.0
	Max	395	7.3	253	29.8	7.0	414	33.1	15.2	13.7	5.3	165.3	12.1	17.5	31.7
	Mean	235	5.1	160	25.4	6.4	304	27.6	13.0	12.2	4.4	135.8	10.1	15.0	25.9
	SD	59	1.4	40	1.2	0.3	57	3.2	1.4	1.2	0.5	16.4	1.4	1.8	3.4
	CV (%)	25.0	27.5	24.9	4.9	4.5	18.9	11.7	10.9	10.0	11.3	12.1	13.5	11.8	13.2
	S-W Statistic	0.81	0.93	0.93	0.94	0.97	0.92	0.92	0.88	0.92	0.92	0.90	0.96	0.93	0.95
	S-W p-value	0.028	0.475	0.498	0.626	0.878	0.426	0.432	0.164	0.398	0.389	0.238	0.811	0.501	0.661

EC electrical conductivity; T temperature; DO dissolved oxygen; ORP oxidation-reduction potential; TDS total dissolved solids.

Values in bold show variables with a significantly non-normal distribution at a p-value < 0.05

Site code	Statistic	ORP [mV]	DO [mg/L]	TDS [ppm]	T [°C]	pH	EC [µS/cm]	Ca ²⁺ [mg/L]	Mg ²⁺ [mg/L]	Na ⁺ [mg/L]	K ⁺ [mg/L]	HCO ₃ ⁻ [mg/L]	Cl ⁻ [mg/L]	SO ₄ ²⁻ [mg/L]	NO ₃ ⁻ [mg/L]
RN21	Min	108	5.1	36	21.6	5.9	73	18.2	7.6	5.3	2.0	55.6	7.2	6.1	30.7
	Max	288	8.4	160	23.7	7.0	352	22.8	10.0	7.0	2.5	83.3	9.6	8.9	38.5
	Mean	208	6.5	106	22.3	6.4	213	19.9	8.5	6.0	2.2	67.5	8.0	7.4	34.1
	SD	55	1.0	30	0.6	0.3	64	1.3	0.6	0.5	0.2	9.3	0.6	0.7	2.3
	CV (%)	26.4	15.6	28.0	2.5	4.9	30.2	6.7	6.9	8.6	7.6	13.8	7.3	9.3	6.7
	S-W Statistic	0.91	0.96	0.89	0.86	0.91	0.94	0.89	0.95	0.90	0.91	0.87	0.89	0.78	0.97
	S-W p-value	0.463	0.841	0.343	0.223	0.446	0.653	0.340	0.743	0.404	0.475	0.267	0.382	0.055	0.859
RN22	Min	154	4.1	70	21.2	5.6	140	15.2	6.4	5.6	2.5	75.5	4.8	3.8	17.1
	Max	357	7.6	309	26.1	7.0	350	22.2	9.5	7.4	3.6	115.1	6.9	6.1	27.8
	Mean	226	6.2	119	22.3	6.4	203	19.8	8.6	6.8	3.1	92.3	5.8	4.8	21.1
	SD	59	1.0	55	1.0	0.3	52	1.6	0.7	0.4	0.3	9.6	0.5	0.6	2.6
	CV (%)	26.1	15.8	46.2	4.4	5.4	25.6	8.3	8.3	6.5	8.3	10.4	8.6	11.5	12.3
	S-W Statistic	0.89	0.89	0.95	0.93	0.94	0.91	0.97	0.97	0.87	0.88	0.88	0.96	0.95	0.96
	S-W p-value	0.366	0.359	0.753	0.603	0.658	0.470	0.849	0.885	0.275	0.315	0.292	0.789	0.739	0.789
RN27	Min	134	2.5	87	22.0	5.9	173	16.6	7.0	4.0	1.4	64.1	6.5	4.2	27.1
	Max	316	8.8	220	23.5	6.8	402	33.1	15.1	9.3	3.4	96.9	15.5	11.4	55.6
	Mean	230	6.1	128	22.5	6.2	263	22.8	9.8	6.2	2.2	74.9	9.9	6.5	40.7
	SD	46	1.9	32	0.4	0.3	68	4.0	1.7	1.1	0.4	8.5	2.0	1.7	6.6
	CV (%)	20.0	30.6	25.3	1.7	4.8	25.8	17.5	16.9	18.3	17.9	11.4	20.1	25.5	16.2
	S-W Statistic	0.71	0.98	0.94	0.83	0.95	0.90	0.79	0.84	0.81	0.89	0.79	0.70	0.80	0.91
	S-W p-value	0.012	0.941	0.635	0.148	0.705	0.428	0.071	0.173	0.103	0.337	0.065	0.009	0.088	0.471
RN29	Min	124	5.0	99	21.5	5.8	196	15.9	5.4	4.4	1.8	74.2	4.5	2.9	15.6
	Max	457	7.4	302	23.1	6.9	327	24.7	10.0	8.8	3.9	116.0	11.0	5.7	32.4
	Mean	226	6.4	134	22.2	6.3	240	22.0	8.6	7.2	3.2	93.3	7.8	4.4	26.5
	SD	93	0.8	56	0.4	0.3	37	2.4	1.1	1.1	0.5	11.4	1.9	0.8	4.0
	CV (%)	41.2	12.7	41.6	1.9	4.3	15.3	11.0	13.2	15.8	15.4	12.2	24.2	18.7	15.2
	S-W Statistic	0.97	0.90	0.81	0.94	0.86	0.94	0.99	0.98	0.80	1.00	0.77	1.00	0.93	0.99
	S-W p-value	0.654	0.389	0.144	0.537	0.278	0.516	0.823	0.751	0.124	0.927	0.040	0.928	0.505	0.831
RN30	Max	424	9.5	374	27.8	7.3	720	22.4	10.3	7.6	3.8	104.8	7.0	4.9	30.9
	Mean	202	6.4	111	22.2	6.5	217	18.1	8.3	6.3	3.1	92.1	4.8	3.7	18.4
	SD	77	1.4	71	1.5	0.5	130	1.7	0.6	0.6	0.3	8.2	0.8	0.7	4.3
	CV (%)	38.3	21.3	64.2	6.7	7.2	59.8	9.1	7.7	9.0	10.5	8.9	17.5	20.0	23.2
	S-W Statistic	0.9	0.9	0.9	0.6	0.9	1.0	1.0	0.9	0.9	1.0	0.9	0.9	1.0	0.9
	S-W p-value	0.253	0.313	0.410	0.001	0.273	0.794	0.993	0.727	0.370	0.751	0.320	0.715	0.943	0.508

EC electrical conductivity; T temperature; DO dissolved oxygen; ORP oxidation-reduction potential; TDS total dissolved solids.

Values in bold show variables with a significantly non-normal distribution at a p-value < 0.05

Site code	Statistic	ORP [mV]	DO [mg/L]	TDS [ppm]	T [°C]	pH	EC [µS/cm]	Ca ²⁺ [mg/L]	Mg ²⁺ [mg/L]	Na ⁺ [mg/L]	K ⁺ [mg/L]	HCO ₃ ⁻ [mg/L]	Cl ⁻ [mg/L]	SO ₄ ²⁻ [mg/L]	NO ₃ ⁻ [mg/L]
RN31	Min	92	5.2	69	21.8	5.8	160	15.2	5.1	5.8	1.2	77.0	5.9	4.7	23.5
	Max	716	8.7	521	25.8	7.5	679	26.6	10.1	8.6	3.9	118.2	11.4	8.0	34.6
	Mean	281	6.2	161	22.5	6.4	279	22.8	8.6	7.2	3.3	97.5	7.2	5.4	26.9
	SD	168	1.0	107	1.0	0.4	123	2.6	1.0	0.6	0.6	16.4	1.2	0.6	2.4
	CV (%)	59.7	16.2	66.3	4.4	6.7	44.1	11.3	11.9	8.8	18.0	16.8	17.2	12.0	9.1
	S-W Statistic	0.86	0.91	0.86	0.73	0.93	0.92	0.86	0.66	0.82	0.68	0.76	0.88	0.87	0.89
	S-W p-value	0.232	0.473	0.232	0.021	0.569	0.557	0.242	0.003	0.124	0.006	0.036	0.303	0.252	0.340
RN32	Min	172	4.4	58	23.3	5.6	116	12.6	4.7	3.9	1.1	31.3	6.6	1.9	25.9
	Max	319	7.8	164	25.8	6.7	330	22.9	8.7	7.1	3.2	90.8	11.1	5.3	38.6
	Mean	238	5.8	94	23.9	6.2	168	16.1	5.8	5.4	1.6	47.3	8.8	3.2	32.6
	SD	47	1.3	32	0.7	0.4	57	2.6	1.1	0.9	0.6	14.0	1.1	1.1	3.8
	CV (%)	19.8	21.5	33.8	3.0	6.3	33.9	16.4	18.3	16.8	34.9	29.6	12.2	34.6	11.5
	S-W Statistic	0.95	0.96	0.96	0.92	0.92	0.93	0.90	0.77	0.97	0.73	0.71	1.00	0.99	0.96
	S-W p-value	0.722	0.833	0.790	0.502	0.548	0.583	0.429	0.045	0.896	0.020	0.013	0.994	0.980	0.814
RN33	Min	74	3.2	85	24.3	5.7	170	20.0	6.9	7.2	2.1	64.8	8.5	6.3	19.3
	Max	353	9.5	237	26.4	7.0	359	30.4	10.2	9.4	3.0	98.6	17.1	15.7	42.3
	Mean	226	5.8	131	25.3	6.4	236	24.4	8.4	8.4	2.5	82.7	11.6	10.5	31.3
	SD	66	1.7	41	0.6	0.3	48	3.2	1.0	0.7	0.2	9.3	1.9	2.4	5.6
	CV (%)	29.4	28.8	31.3	2.2	5.3	20.5	12.9	11.9	7.7	9.7	11.2	16.5	23.0	17.8
	S-W Statistic	0.97	0.93	0.90	0.91	0.97	0.91	0.91	0.97	0.97	0.95	0.86	0.82	0.92	0.80
	S-W p-value	0.865	0.528	0.310	0.391	0.897	0.374	0.366	0.876	0.885	0.768	0.159	0.065	0.443	0.041
RN38	Min	161	6.3	43	14.4	5.7	87	9.1	5.4	3.5	2.0	48.0	1.9	3.6	3.2
	Max	270	7.8	99	18.4	6.8	204	11.2	6.2	4.6	2.6	77.5	2.8	6.9	7.6
	Mean	214	7.0	71	17.0	6.4	126	10.2	5.8	4.2	2.3	66.0	2.4	4.9	5.2
	SD	52	0.6	40	1.8	0.4	41	0.8	0.4	0.4	0.2	10.8	0.3	1.2	1.7
	CV (%)	24.4	8.9	55.8	10.5	6.1	32.6	7.6	6.1	9.5	10.9	16.4	12.2	24.9	31.8
RN39	Min	171	5.7	36	17.7	5.9	71	8.3	4.2	4.1	2.5	57.9	1.4	3.7	1.2
	Max	264	7.5	72	18.1	7.4	152	10.5	5.3	4.9	3.2	72.5	2.1	6.2	3.1
	Mean	225	6.5	56	17.9	6.6	110	9.3	4.7	4.5	2.9	63.6	1.8	5.1	1.8
	SD	45	0.8	18	0.2	0.6	33	1.2	0.6	0.4	0.3	6.3	0.3	1.1	0.9
	CV (%)	19.9	12.4	32.7	1.0	9.3	30.1	12.6	12.2	8.5	11.4	9.9	16.1	21.2	46.1
	S-W Statistic	0.79	0.86	0.96	1.00	0.92	1.00	0.75	0.85	0.85	1.00	0.94	0.75	1.00	0.82
	S-W p-value	0.091	0.277	0.637	1.000	0.451	0.878	0.006	0.242	0.245	0.979	0.536	0.000	0.913	0.169

EC electrical conductivity; T temperature; DO dissolved oxygen; ORP oxidation-reduction potential; TDS total dissolved solids.

Values in bold show variables with a significantly non-normal distribution at a p-value < 0.05

Site code	Statistic	ORP [mV]	DO [mg/L]	TDS [ppm]	T [°C]	pH	EC [µS/cm]	Ca ²⁺ [mg/L]	Mg ²⁺ [mg/L]	Na ⁺ [mg/L]	K ⁺ [mg/L]	HCO ₃ ⁻ [mg/L]	Cl ⁻ [mg/L]	SO ₄ ²⁻ [mg/L]	NO ₃ ⁻ [mg/L]
RN40	Min	156	6.2	82	22.0	6.1	164	22.0	7.9	7.3	3.5	84.4	6.6	5.6	25.4
	Max	461	9.1	185	23.3	6.8	293	26.9	9.8	8.9	4.3	116.7	10.2	9.9	47.5
	Mean	249	7.7	123	22.5	6.5	223	24.9	8.9	7.9	4.0	98.6	8.2	7.6	31.5
	SD	99	0.9	32	0.4	0.2	42	1.6	0.7	0.4	0.3	9.9	1.4	1.6	6.4
	CV (%)	39.6	11.7	25.9	1.7	3.3	18.7	6.6	7.7	5.3	7.2	10.0	16.6	20.9	20.3
	S-W Statistic	0.84	0.93	0.89	0.94	0.94	0.90	0.92	0.92	0.97	0.75	0.83	0.89	0.88	0.88
	S-W p-value	0.175	0.620	0.364	0.685	0.644	0.394	0.521	0.549	0.848	0.029	0.142	0.334	0.312	0.302
EN68	Min				16.7	6.8	69	8.5	3.3	3.7	2.1	54.2	1.6	1.1	1.0
	Max				17.6	7.2	88	8.9	3.5	3.7	2.5	57.6	1.9	1.6	1.8
	Mean				17.3	7.1	80	8.7	3.4	3.7	2.3	55.7	1.8	1.4	1.4
	SD				0.5	0.3	9.8	0.2	0.1	0.0	0.2	1.7	0.2	0.3	0.4
	CV (%)				0.03	0.04	0.12	0.02	0.03	0.01	0.07	0.03	0.11	0.19	0.29
<i>Upper Colima</i>															
RN07	Min	167	5.6	42	22.1	5.6	60	11.8	5.3	4.0	1.5	56.5	2.2	0.9	12.1
	Max	285	6.9	188	27.5	7.4	359	17.2	8.2	6.6	2.6	100.3	4.3	3.6	20.9
	Mean	234	6.0	86	23.7	6.4	169	13.7	6.4	4.9	1.9	71.2	3.0	2.0	16.2
	SD	42	0.5	36	1.6	0.5	84	1.3	0.7	0.6	0.3	10.8	0.5	0.6	2.1
	CV (%)	18.1	8.0	41.9	6.6	7.9	49.5	9.7	10.3	13.1	18.1	15.2	17.3	32.0	12.9
	S-W Statistic	0.87	0.98	0.89	0.88	0.87	0.95	0.86	0.92	0.76	0.56	0.80	0.73	0.85	0.89
	S-W p-value	0.067	0.674	0.674	0.649	0.786	0.568	0.743	0.348	0.362	0.547	0.359	0.074	0.540	0.869
RN14	Min	165	5.9	96	20.2	5.8	180	13.8	6.6	7.3	3.8	77.2	8.7	5.1	13.7
	Max	380	9.1	208	25.8	6.8	365	26.0	11.9	11.7	5.8	138.5	12.4	9.7	30.4
	Mean	266	7.5	145	22.4	6.5	253	22.4	10.5	10.5	4.5	115.5	10.8	7.7	22.0
	SD	61	0.9	34	1.2	0.3	52	2.7	1.1	1.0	0.4	15.0	1.1	1.0	3.6
	CV (%)	22.9	12.4	23.5	5.2	4.4	20.4	11.9	10.9	9.0	10.0	13.0	9.8	12.6	16.1
	S-W Statistic	0.90	0.98	0.92	0.95	0.93	0.92	0.88	0.91	0.97	0.98	0.92	0.94	0.79	0.95
	S-W p-value	0.396	0.968	0.536	0.780	0.585	0.540	0.264	0.457	0.891	0.970	0.508	0.690	0.051	0.768
RN35	Min	109	3.5	69	20.7	5.8	138	14.3	5.0	5.5	2.1	56.8	6.9	18.7	5.5
	Max	301	8.8	145	25.0	7.0	482	20.2	12.5	8.4	3.5	86.2	10.5	28.1	14.6
	Mean	194	6.1	115	21.8	6.5	237	17.9	9.9	6.9	2.9	73.6	9.2	24.5	10.3
	SD	57	1.4	21	1.0	0.3	75	1.6	1.5	0.6	0.3	8.0	0.9	2.6	1.8
	CV (%)	29.5	23.0	18.5	4.6	5.0	31.7	8.7	14.8	9.1	10.9	10.8	10.0	10.5	17.5
	S-W Statistic	0.92	0.96	0.93	0.91	0.93	0.98	0.90	0.62	0.96	0.95	0.96	0.93	0.99	0.76
	S-W p-value	0.484	0.859	0.569	0.373	0.511	0.977	0.314	0.001	0.836	0.702	0.791	0.570	0.987	0.016

EC electrical conductivity; T temperature; DO dissolved oxygen; ORP oxidation-reduction potential; TDS total dissolved solids.

Values in bold show variables with a significantly non-normal distribution at a p-value < 0.05

Site code	Statistic	ORP [mV]	DO [mg/L]	TDS [ppm]	T [°C]	pH	EC [µS/cm]	Ca ²⁺ [mg/L]	Mg ²⁺ [mg/L]	Na ⁺ [mg/L]	K ⁺ [mg/L]	HCO ₃ ⁻ [mg/L]	Cl ⁻ [mg/L]	SO ₄ ²⁻ [mg/L]	NO ₃ ⁻ [mg/L]
RN36	Min	6	5.5	80	22.1	6.6	159	12.9	10.6	9.3	3.9	83.9	7.1	11.5	3.3
	Max	227	8.0	175	25.1	7.3	221	16.6	12.3	11.3	5.0	108.1	10.4	24.2	10.4
	Mean	151	6.6	112	23.8	6.9	192	15.1	11.6	10.7	4.4	94.7	9.1	20.4	5.4
	SD	79	0.8	33	1.0	0.3	26	1.2	0.6	0.7	0.3	9.5	1.2	4.0	2.4
	CV (%)	52.2	12.5	29.8	4.4	4.0	13.3	8.0	5.1	6.2	7.9	10.1	13.3	19.5	44.0
	S-W Statistic	0.92	0.98	0.82	0.94	0.81	0.87	0.98	0.92	0.90	0.95	0.90	0.86	0.91	0.91
	S-W p-value	0.532	0.919	0.118	0.685	0.096	0.277	0.933	0.549	0.395	0.716	0.430	0.240	0.462	0.444
RN43	Min	202	3.7	99	22.1	6.3	198	15.4	12.2	15.2	5.3	101.3	14.5	19.5	5.6
	Max	319	7.1	200	25.4	7.1	297	19.5	14.8	19.0	6.2	123.3	17.7	25.4	11.7
	Mean	251	6.0	140	23.5	6.8	251	17.9	13.3	17.3	5.7	113.3	16.1	22.8	9.7
	SD	44	1.1	35	1.1	0.3	34	1.4	0.8	1.3	0.3	8.8	1.0	2.0	1.8
	CV (%)	17.5	18.9	24.8	4.5	5.1	13.7	7.6	6.3	7.3	5.5	7.7	6.5	8.6	18.3
	S-W Statistic	0.95	0.84	0.96	0.95	0.86	0.99	0.82	0.91	0.90	0.99	0.92	0.88	0.90	0.87
	S-W p-value	0.720	0.197	0.803	0.697	0.246	0.946	0.147	0.500	0.418	0.977	0.534	0.325	0.412	0.281
RN44	Min	138	5.5	90	22.9	6.7	180	16.2	12.2	11.2	4.4	89.0	9.4	21.8	4.6
	Max	313	7.4	179	24.9	7.5	236	17.6	13.1	12.4	5.1	117.7	12.0	27.0	6.5
	Mean	217	6.4	119	23.9	7.0	210	17.0	12.8	11.9	4.7	100.3	10.7	23.9	5.3
	SD	61	0.8	30	0.6	0.3	23	0.5	0.3	0.4	0.3	10.5	0.8	1.7	0.7
	CV (%)	28.0	12.6	25.4	2.5	4.3	11.0	2.9	2.4	3.2	5.9	10.5	7.7	7.1	13.4
	S-W Statistic	0.77	0.84	0.76	0.91	0.98	0.79	0.93	0.83	0.82	0.91	0.86	0.91	0.98	0.89
	S-W p-value	0.048	0.173	0.038	0.493	0.953	0.066	0.607	0.134	0.123	0.495	0.216	0.483	0.936	0.367
RN45	Min	179	6.8	91	21.5	6.2	183	20.2	10.8	10.0	4.3	105.2	8.6	6.3	16.7
	Max	377	8.8	192	23.5	7.5	260	24.3	12.4	12.2	4.9	137.8	10.4	8.2	20.2
	Mean	255	7.6	129	22.5	6.7	228	22.1	11.4	10.9	4.6	116.7	9.4	7.1	19.1
	SD	68	0.7	32	0.8	0.4	31	1.3	0.6	0.7	0.2	11.0	0.6	0.7	1.1
	CV (%)	26.6	9.1	25.1	3.4	5.5	13.7	6.0	4.9	6.6	5.1	9.5	5.9	9.6	5.5
	S-W Statistic	0.91	0.98	0.94	0.98	0.76	0.94	0.95	0.96	0.95	0.95	0.91	0.84	0.99	0.95
	S-W p-value	0.472	0.895	0.631	0.917	0.044	0.631	0.716	0.749	0.688	0.695	0.494	0.203	0.940	0.735
RN46	Min	109	6.8	89	22.0	6.7	179	14.7	12.4	11.6	4.3	86.4	10.4	23.2	3.3
	Max	209	10.1	171	26.4	7.4	263	15.7	13.2	12.5	5.2	110.5	12.2	27.3	6.9
	Mean	159	7.7	118	23.4	7.0	210	15.3	12.8	12.0	4.8	98.3	11.3	24.8	4.4
	SD	45	1.2	30	1.4	0.2	32	0.5	0.3	0.3	0.3	7.9	0.8	1.4	1.3
	CV (%)	28.2	15.5	25.6	6.0	3.5	15.1	3.0	2.5	2.7	7.3	8.0	6.8	5.8	28.6
	S-W Statistic	0.78	0.99	0.79	0.88	0.75	0.83	0.74	0.94	0.90	0.83	0.81	0.88	0.86	0.96
	S-W p-value	0.074	0.954	0.091	0.345	0.038	0.156	0.034	0.646	0.453	0.166	0.131	0.352	0.253	0.760

EC electrical conductivity; T temperature; DO dissolved oxygen; ORP oxidation-reduction potential; TDS total dissolved solids.

Values in bold show variables with a significantly non-normal distribution at a p-value < 0.05

Site code	Statistic	ORP [mV]	DO [mg/L]	TDS [ppm]	T [°C]	pH	EC [µS/cm]	Ca ²⁺ [mg/L]	Mg ²⁺ [mg/L]	Na ⁺ [mg/L]	K ⁺ [mg/L]	HCO ₃ ⁻ [mg/L]	Cl ⁻ [mg/L]	SO ₄ ²⁻ [mg/L]	NO ₃ ⁻ [mg/L]
EN69	Min	213		34	21.4	6.6	74	19.5	8.0	7.6	4.1	98.0	6.6	5.4	19.6
	Max	338		75	21.6	7.1	151	19.9	8.5	7.6	4.2	101.5	7.1	6.6	21.3
	Mean	276		55	21.5	6.8	113	19.7	8.2	7.6	4.2	99.8	6.9	6.0	20.5
	SD	88		29	0.1	0.4	54	0.3	0.4	0.0	0.1	2.5	0.4	0.9	1.2
	CV (%)	0.3		0.5	0.0	0.1	0.5	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
EN70	Min				17.9	6.3	98	8.4	4.2	5.4	1.9	64.9	2.3	1.0	0.8
	Max				21.7	7.5	182	18.5	6.9	7.0	4.7	92.8	8.1	2.4	24.5
	Mean				20.3	6.7	139	15.1	6.0	6.5	3.7	82.5	6.0	1.7	14.4
	SD				2.1	0.7	42	5.8	1.6	1.0	1.6	15.3	3.2	0.7	12.3
	CV (%)				0.1	0.1	0.3	0.4	0.3	0.1	0.4	0.2	0.5	0.4	0.9
EN75	Min				20.3	6.5	122	15.7	7.1	6.5	3.5	90.4	3.6	2.2	10.8
	Max				20.6	7.2	166	16.0	7.3	6.7	3.7	94.5	4.5	2.8	15.2
	Mean				20.5	6.9	151	15.9	7.2	6.6	3.6	93.1	4.1	2.6	12.9
	SD				0.2	0.4	25	0.2	0.1	0.1	0.1	2.3	0.5	0.4	2.2
	CV (%)				0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2
EN77	Min				20.7	6.2	123	14.6	5.0	5.7	4.6	66.4	5.0	3.4	19.6
	Max				20.8	6.8	146	16.0	5.5	5.9	4.8	71.3	5.4	4.3	20.9
	Mean				20.8	6.5	134	15.3	5.3	5.8	4.7	68.9	5.2	3.8	20.2
	SD				0.1	0.4	16	1.0	0.3	0.1	0.2	3.5	0.3	0.6	0.9
	CV (%)				0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.2	0.0
Lower Colima															
RN09	Min	85	3.8	49	17.1	5.8	210	8.7	8.1	17.8	6.6	84.3	18.1	16.9	1.8
	Max	334	9.6	361	23.6	7.9	728	19.2	16.5	32.4	12.7	163.9	31.6	32.1	4.7
	Mean	183	8.0	213	21.4	7.0	417	15.8	13.3	27.2	10.1	131.3	26.4	27.1	2.8
	SD	69	1.8	74	1.2	0.7	137	2.3	1.6	2.9	1.5	17.2	2.7	2.9	0.8
	CV (%)	37.5	22.6	34.8	5.8	9.6	32.7	14.3	12.4	10.7	15.1	13.1	10.1	10.9	29.0
	S-W Statistic	1	0.9	1	0.9	0.9	1	0.8	0.9	0.9	0.9	1.0	0.8	0.9	0.8
	S-W p-value	0.589	0.672	0.274	0.517	0.330	0.240	0.203	0.639	0.635	0.492	0.988	0.198	0.622	0.061

EC electrical conductivity; T temperature; DO dissolved oxygen; ORP oxidation-reduction potential; TDS total dissolved solids.

Values in bold show variables with a significantly non-normal distribution at a p-value < 0.05

Site code	Statistic	ORP [mV]	DO [mg/L]	TDS [ppm]	T [°C]	pH	EC [µS/cm]	Ca ²⁺ [mg/L]	Mg ²⁺ [mg/L]	Na ⁺ [mg/L]	K ⁺ [mg/L]	HCO ₃ ⁻ [mg/L]	Cl ⁻ [mg/L]	SO ₄ ²⁻ [mg/L]	NO ₃ ⁻ [mg/L]
RN15	Min	146	6.2	81	21.5	6.3	160	9.9	6.6	7.2	2.4	73.7	5.6	5.7	6.5
	Max	279	8.6	183	23.7	7.3	392	26.3	11.3	14.3	5.8	133.0	11.3	10.2	14.5
	Mean	223	7.3	123	22.3	6.9	223	16.1	9.8	11.9	4.7	107.7	9.5	8.0	10.3
	SD	39	0.8	29	0.6	0.3	52	3.3	1.0	1.5	0.8	12.8	1.2	1.0	1.6
	CV (%)	17.5	11.0	23.6	2.8	3.7	23.5	20.5	10.5	12.2	16.1	11.9	12.1	12.1	15.8
	S-W Statistic	0.83	0.96	0.94	0.90	0.94	0.90	0.80	0.85	0.87	0.93	0.95	0.97	0.90	0.67
	S-W p-value	0.108	0.822	0.627	0.368	0.664	0.348	0.054	0.151	0.225	0.552	0.749	0.919	0.396	0.003
RN37	Min	116	4.9	116	22.6	6.4	234	15.5	15.5	15.0	5.7	105.5	17.1	34.8	3.1
	Max	218	8.1	240	23.8	7.9	320	19.9	17.9	16.5	6.6	126.9	19.3	38.4	6.4
	Mean	162	6.5	159	23.1	7.1	277	18.4	17.3	15.8	6.1	116.1	18.0	35.8	4.8
	SD	40	1.0	45	0.4	0.6	39	1.4	0.8	0.6	0.4	7.8	0.7	1.1	1.1
	CV (%)	24.4	16.0	28.3	1.7	7.8	14.2	7.7	4.4	3.5	7.0	6.7	3.8	3.1	22.8
	S-W Statistic	0.90	0.99	0.85	0.98	0.88	0.83	0.81	0.70	0.92	0.76	0.89	0.88	0.76	0.99
	S-W p-value	0.391	0.995	0.158	0.969	0.292	0.108	0.074	0.007	0.540	0.027	0.341	0.260	0.028	0.977
RN42	Min	203	6.4	85	21.6	6.3	171	14.7	9.6		5.4	95.6	11.4	10.1	7.7
	Max	375	8.5	173	24.5	7.3	241	18.2	11.2	15.1	6.2	120.5	12.9	12.4	9.4
	Mean	268	7.3	120	22.9	6.9	213	16.6	10.3	14.3	5.7	106.7	12.3	11.2	8.6
	SD	65	0.9	28	0.9	0.3	23	1.2	0.6	0.6	0.3	8.9	0.4	0.7	0.7
	CV (%)	24.4	11.8	22.9	4.1	4.3	10.7	7.2	5.6	4.3	4.8	8.3	3.5	6.2	7.7
	S-W Statistic	0.83	0.85	0.98	0.91	0.74	0.99	0.97	0.95	0.95	0.96	0.98	0.96	0.94	0.91
	S-W p-value	0.174	0.232	0.914	0.459	0.030	0.968	0.869	0.737	0.745	0.755	0.902	0.758	0.627	0.508
RN47	Min	97	5.7	113	23.0	6.3	226	15.7	14.5	14.6	5.4	106.5	15.6	29.8	2.8
	Max	184	9.5	244	24.8	7.6	310	17.8	15.2	21.9	7.1	127.8	18.2	35.1	6.8
	Mean	134	7.2	155	23.6	7.0	271	16.8	14.8	19.7	6.3	115.7	17.2	32.6	4.5
	SD	37	1.4	47	0.7	0.5	38	0.7	0.3	2.3	0.7	8.4	0.8	1.6	1.2
	CV (%)	27.7	20.0	30.0	3.0	6.5	13.9	4.2	1.9	11.6	10.8	7.2	4.6	5.0	26.6
	S-W Statistic	0.78	0.80	0.82	0.79	0.98	0.89	0.95	0.94	0.90	1.00	1.00	0.81	0.92	0.97
	S-W p-value	0.078	0.107	0.165	0.094	0.711	0.363	0.589	0.526	0.393	0.970	0.950	0.146	0.449	0.664
RN48	Min	68	6.2	77	20.8	6.9	155	13.4	9.3	11.4	4.8	93.9	9.6	9.9	3.2
	Max	196	7.6	178	22.2	7.3	220	15.6	10.8	13.8	5.5	109.4	11.3	12.9	5.9
	Mean	134	6.9	112	21.4	7.1	187	14.6	9.7	12.2	5.3	103.0	10.3	11.0	4.5
	SD	46	0.7	42	0.7	0.2	32	0.7	0.6	0.8	0.3	6.1	0.6	1.0	0.9
	CV (%)	34.3	10.6	37.4	3.0	2.4	17.2	5.0	5.7	6.9	5.7	5.9	5.7	9.5	20.8
	S-W Statistic	0.96	0.98	0.75	0.96	1.00	0.75	0.99	0.92	0.91	0.78	0.91	0.92	1.00	0.79
	S-W p-value	0.618	0.745	0.000	0.637	0.900	0.000	0.783	0.463	0.430	0.057	0.414	0.448	0.878	0.099

EC electrical conductivity; T temperature; DO dissolved oxygen; ORP oxidation-reduction potential; TDS total dissolved solids.

Values in bold show variables with a significantly non-normal distribution at a p-value < 0.05

Table S3. Comparison between dry and wet seasons within each sampling site for each major ion, by using Mann-Whitney U test, in Barva and Colima multi-aquifer system.

Ca ²⁺ [mg/L]																					Mg ²⁺ [mg/L]					Na ⁺ [mg/L]					K ⁺ [mg/L]				
Dry						Wet					Dry					Wet					Dry					Wet									
Site	M	CV	M	CV	M-W p-value	M	CV	M	CV	M-W p-value	M	CV	M	CV	M-W p-value	M	CV	M	CV	M-W p-value															
Upper Barva																																			
RN02	5.7	10.9	5.8	11.0	0.965	1.3	7.2	1.3	9.2	0.570	3.5	9.8	3.4	11.1	0.570	2.0	10.0	1.9	9.5	0.965															
RN03	8.7	12.4	8.2	15.0	0.457	4.1	11.2	3.9	14.3	0.409	5.1	8.5	4.7	14.4	0.069	2.7	15.8	2.6	12.7	0.934															
RN23	13.7	14.4	11.8	8.5	0.127	5.9	15.8	5.1	8.5	0.074	5.6	29.5	5.2	14.3	0.570	2.3	17.1	2.3	16.7	0.965															
Lower Barva																																			
RN01	12.2	4.0	10.7	26.5	0.063	5.0	3.9	4.8	29.9	0.237	6.2	9.7	5.2	12.1	0.011	2.8	2.7	2.5	12.8	0.028															
RN06	16.0	5.6	16.6	16.1	0.720	7.7	4.3	8.1	16.4	0.531	5.6	7.7	5.3	13.5	0.654	2.8	10.2	3.1	23.7	0.531															
RN08	16.7	7.6	17.8	6.7	0.139	6.7	8.5	6.8	7.4	0.405	5.0	5.2	4.8	4.1	0.405	2.0	10.8	2.1	14.2	0.459															
RN12	17.5	10.4	17.9	12.1	0.364	8.6	4.7	8.5	6.2	0.680	6.8	13.8	6.7	6.6	1.000	3.2	12.9	3.1	13.4	0.836															
RN13	27.9	7.0	29.3	8.0	0.594	9.7	5.2	9.8	8.2	0.477	9.9	13.4	9.6	9.9	0.594	4.4	24.7	4.4	9.8	0.906															
RN17	28.6	7.5	26.8	12.3	0.631	12.8	6.0	12.5	11.7	0.570	12.9	4.1	12.3	10.8	0.315	4.3	9.5	4.4	11.4	0.896															
RN21	19.6	4.9	19.9	6.7	0.586	8.3	4.5	8.4	7.0	0.815	5.8	10.4	6.0	7.5	0.938	2.3	7.9	2.1	6.7	0.391															
RN22	18.7	10.1	20.1	6.4	0.108	8.5	10.7	8.8	6.6	0.127	7.0	8.5	6.7	5.6	0.906	3.0	11.3	3.2	6.6	0.346															
RN27	21.8	3.3	22.0	18.7	0.671	9.1	3.0	9.7	17.9	0.288	6.1	11.0	5.9	19.3	0.243	2.3	13.3	2.2	18.4	0.595															
RN29	21.3	7.1	22.2	11.4	1.000	8.2	9.5	8.6	13.4	0.866	7.5	8.6	7.3	16.2	0.398	3.3	9.8	3.4	15.8	0.735															
RN30	18.2	4.6	17.9	9.7	0.617	8.3	2.9	8.3	8.4	0.764	6.7	5.8	6.1	8.8	0.134	3.0	13.8	3.0	8.9	0.764															
RN31	22.6	4.5	23.4	12.2	0.760	8.8	2.9	9.0	13.3	0.827	7.4	3.0	7.3	9.5	0.827	3.4	7.8	3.5	19.3	0.896															
RN32	14.3	17.1	16.1	14.7	0.258	5.6	18.4	5.6	17.3	0.888	4.8	20.4	5.6	13.7	0.322	1.6	30.6	1.5	34.8	0.777															
RN33	26.6	5.3	23.0	12.9	0.046	9.4	4.1	7.9	10.5	0.016	8.9	5.7	8.3	7.4	0.110	2.6	9.0	2.4	8.6	0.162															
RN38	10.9	0.0	9.9	6.9	0.380	6.2	0.0	5.8	5.2	0.143	4.6	0.0	4.2	8.4	0.143	2.4	0.0	2.2	10.6	0.380															
RN39	10.5	0.0	8.3	9.7	0.180	5.2	0.0	4.3	10.5	0.655	4.9	0.0	4.2	6.9	0.180	3.2	0.0	2.8	9.8	0.180															
RN40	23.9	7.8	25.1	5.4	0.296	8.0	1.0	9.3	5.8	0.037	7.5	3.0	7.9	4.5	0.089	3.7	3.9	4.1	6.1	0.117															
Upper Colima																																			
RN07	13.7	4.3	13.5	10.5	0.903	6.2	5.1	6.4	11.1	0.716	4.7	16.6	4.7	10.1	0.628	1.8	19.8	1.8	16.7	1.000															
RN14	20.3	6.3	23.1	11.9	0.089	9.9	4.5	10.7	11.3	0.128	10.2	7.6	10.7	9.1	0.720	4.4	16.0	4.5	7.3	0.858															
RN35	18.7	2.9	17.8	9.2	0.186	10.2	5.2	10.1	15.9	0.508	7.1	6.4	6.8	9.0	0.156	3.0	10.9	2.8	9.9	0.395															
RN36	16.6	0.0	15.0	7.1	0.127	11.4	0.0	11.8	5.0	0.513	9.3	0.0	11.0	3.3	0.127	4.3	0.0	4.3	7.9	0.827															
RN43	17.0	9.2	17.6	5.7	0.380	12.9	5.1	13.0	5.8	0.380	15.8	3.9	17.3	5.2	0.040	5.7	3.8	5.7	5.5	0.770															
RN44	16.2	0.2	17.2	1.3	0.040	12.5	2.7	12.9	1.5	0.079	12.1	2.6	11.9	3.0	1.000	4.8	5.9	4.5	5.4	0.659															
RN45	21.7	3.0	21.8	6.2	1.000	11.0	1.8	11.2	4.7	0.380	10.7	3.0	10.7	6.8	0.770	4.5	6.1	4.6	4.2	0.558															
RN46	14.7	0.0	15.5	2.5	0.124	12.5	0.0	13.0	2.3	0.275	11.9	0.0	11.9	2.6	0.827	5.1	0.0	4.8	6.8	0.275															
Lower Colima																																			
RN09	16.9	11.7	16.3	14.6	1.000	13.5	8.7	13.4	12.8	0.509	27.6	7.2	27.4	11.1	0.457	9.5	13.6	9.8	14.8	0.364															
RN15	16.0	8.6	16.1	21.7	0.777	9.7	6.0	9.9	11.0	0.705	12.2	9.2	11.9	12.5	0.705	4.6	15.1	4.8	15.8	0.850															
RN37	18.4	0.0	18.9	7.7	0.513	17.7	0.0	17.4	4.3	0.513	15.7	0.0	15.9	3.5	0.513	6.6	0.0	5.8	6.2	0.127															
RN42	15.9	7.4	16.8	6.0	0.380	10.1	5.7	10.2	5.0	0.558	13.9	4.6	14.6	3.5	0.242	5.5	2.2	5.6	4.7	0.462															
RN47	16.8	0.0	17.0	4.2	0.827	14.8	0.0	14.7	1.9	0.827	19.9	0.0	20.2	11.6	0.827	7.0	0.0	5.9	9.9	0.275															
RN48	14.4	0.0	14.7	5.0	0.770	9.5	0.0	9.6	5.6	0.770	12.1	0.0	12.0	6.8	0.770	5.5	0.0	5.4	5.3	0.380															

Values in bold show significant differences at a p-value < 0.05.

HCO ₃ ⁻ [mg/L]						Cl ⁻ [mg/L]					SO ₄ ²⁻ [mg/L]					NO ₃ ⁻ [mg/L]					
Dry			Wet			Dry			Wet		M-W p-value	Dry		Wet		M-W p-value	Dry		Wet		M-W p-value
Site	M	CV	M	CV	M-W p-value	M	CV	M	CV	M		CV	M	CV	M		CV	M	CV	M	
Upper Barva																					
RN02	28.3	10.5	27.3	12.6	0.541	1.2	13.7	1.4	24.9	0.631	3.6	8.0	3.4	12.1	0.206	1.6	8.6	1.7	21.1	0.407	
RN23	51.3	21.8	49.3	13.1	0.458	4.3	27.5	4.1	18.2	0.570	14.8	17.4	13.2	21.7	0.694	11.3	28.0	10.4	28.3	0.315	
RN03	31.7	25.5	34.2	13.6	0.409	2.1	9.2	1.9	21.9	0.265	25.0	23.3	17.9	21.5	0.048	2.8	33.3	3.7	32.7	0.013	
Lower Barva																					
RN01	66.5	12.4	69.0	22.3	0.933	2.1	31.9	1.3	22.5	0.052	4.5	13.2	3.5	19.0	0.018	2.4	17.5	1.8	37.9	0.043	
RN06	85.2	7.9	84.2	17.9	0.591	3.6	1.9	4.1	19.5	0.060	2.9	6.4	3.0	14.8	0.858	13.6	4.8	15.0	18.5	0.152	
RN08	53.2	8.1	59.4	11.9	0.033	4.0	9.0	4.0	14.8	0.853	3.6	22.9	4.2	18.7	0.643	44.2	14.8	37.3	17.5	0.116	
RN12	85.7	10.1	95.7	9.9	0.148	5.3	10.2	5.1	11.4	0.248	4.7	12.5	5.3	10.6	0.173	17.1	5.8	16.0	13.9	0.283	
RN13	95.5	7.0	98.8	12.3	0.953	12.9	10.9	14.0	10.5	0.678	10.4	13.8	12.6	10.8	0.173	37.7	4.4	38.8	11.0	0.260	
RN17	131.7	13.5	134.5	11.1	0.827	11.0	8.8	10.1	13.9	0.239	15.3	6.8	15.6	12.7	0.513	25.0	15.3	25.8	11.9	0.631	
RN21	61.7	9.0	66.4	13.4	0.392	7.9	5.4	8.0	7.3	0.815	7.7	0.9	7.4	10.0	0.243	32.9	3.8	34.2	6.5	0.243	
RN22	87.3	4.9	94.3	10.4	0.127	5.9	10.2	5.8	7.8	0.784	4.4	8.9	4.9	10.2	0.038	19.6	12.3	20.7	11.8	0.557	
RN27	72.9	10.2	74.9	11.2	0.832	8.9	7.2	10.1	20.5	0.137	6.5	8.3	5.9	27.8	0.203	35.4	2.0	42.2	15.5	0.019	
RN29	90.3	4.4	94.4	12.7	0.310	8.5	17.8	7.6	24.7	0.612	5.1	12.1	4.3	17.8	0.237	27.1	11.5	26.9	15.0	0.612	
RN30	86.5	10.3	95.9	8.0	0.549	4.7	18.2	4.6	16.4	0.484	3.5	20.0	3.9	19.3	0.841	17.5	24.6	17.9	21.8	0.920	
RN31	94.9	10.6	97.3	18.4	0.631	6.9	5.0	6.9	22.3	0.694	5.2	5.6	5.3	16.8	0.827	26.9	5.0	26.2	9.5	0.513	
RN32	44.4	7.2	44.6	32.8	0.888	8.4	18.8	8.8	7.4	0.480	2.1	22.6	3.6	29.0	0.048	30.6	14.1	33.0	9.4	0.258	
RN33	80.0	14.0	85.3	9.9	0.617	13.4	6.3	10.8	16.2	0.012	13.6	17.7	9.3	18.3	0.036	38.2	10.6	30.2	14.8	0.012	
RN38	77.5	0.0	68.0	14.5	0.143	2.6	0.0	2.5	12.0	0.552	5.7	0.0	4.2	24.3	0.380	3.2	0.0	5.5	23.5	0.143	
RN39	61.9	0.0	62.1	9.6	0.655	2.1	0.0	1.8	9.9	0.157	5.5	0.0	4.9	20.9	0.655	3.1	0.0	1.5	12.9	0.180	
RN40	96.2	2.7	102.4	10.4	0.602	6.9	2.5	8.8	14.5	0.117	5.8	4.0	8.2	17.0	0.037	26.1	2.6	31.9	18.4	0.037	
Upper Colima																					
RN07	73.8	14.5	67.8	14.7	0.467	2.8	20.4	2.9	14.9	1.000	2.1	29.7	1.9	28.9	0.396	15.0	9.6	16.5	13.2	0.628	
RN14	111.5	11.2	117.4	13.0	0.531	10.1	8.6	11.0	9.5	0.325	7.3	10.1	7.6	12.7	0.282	21.0	6.5	21.7	16.9	0.474	
RN35	71.6	5.9	75.6	11.3	0.508	10.2	8.2	9.3	9.7	0.108	24.7	7.7	25.1	10.8	1.000	10.9	2.3	10.0	19.0	0.257	
RN36	100.3	0.0	94.9	9.9	0.513	7.1	0.0	9.7	9.3	0.127	11.5	0.0	22.4	7.9	0.127	10.4	0.0	4.1	25.5	0.127	
RN43	111.3	7.8	117.8	7.1	0.770	15.2	4.6	16.3	5.6	0.143	20.1	3.3	23.1	5.4	0.040	10.1	7.5	9.7	19.2	0.770	
RN44	92.4	1.8	102.7	9.9	0.242	10.6	1.7	10.6	8.1	1.000	23.0	5.4	24.0	6.6	0.380	4.7	3.5	5.9	12.0	0.242	
RN45	116.3	8.9	113.1	8.9	1.000	9.3	4.3	9.2	5.8	0.557	6.8	1.2	7.1	9.7	0.380	19.4	1.1	19.3	5.9	1.000	
RN46	93.6	0.0	98.9	7.7	0.513	10.7	0.0	11.7	6.4	0.827	23.7	0.0	24.4	5.5	0.513	3.4	0.0	4.4	26.2	0.275	
Lower Colima																					
RN09	122.7	7.5	133.5	13.9	0.563	25.7	3.9	26.5	10.8	0.186	27.2	4.0	27.8	11.9	0.248	3.3	28.1	2.6	25.3	0.299	
RN15	109.6	9.7	110.0	12.0	0.741	9.6	6.5	9.4	12.8	0.925	8.0	9.5	7.7	12.3	0.705	11.0	11.9	9.9	15.8	0.257	
RN37	109.7	0.0	120.0	6.3	0.513	17.7	0.0	17.9	3.7	0.827	35.7	0.0	35.6	3.1	0.827	5.0	0.0	4.9	22.9	0.827	
RN42	106.8	5.2	105.4	8.4	1.000	11.8	3.4	12.4	2.4	0.143	10.7	3.9	11.4	5.8	0.242	8.7	6.2	8.8	7.5	0.558	
RN47	112.1	0.0	118.9	7.1	0.827	16.8	0.0	17.3	4.5	0.275	31.7	0.0	32.7	4.8	0.513	4.3	0.0	4.7	26.4	0.827	
RN48	97.2	0.0	105.5	5.2	0.380	9.9	0.0	10.4	5.4	0.380	10.6	0.0	10.9	9.3	0.770	3.9	0.0	4.9	19.4	0.380	

Values in bold show significant differences at a p-value < 0.05.

Table S4. Comparison between aquifers and flow paths by using Mann-Whitney U test, for groundwater in Barva and Colima multi-aquifer system.

Variable	Aquifer	ORP [mV]	O ₂ [mg/L]	TDS [ppm]	T [°C]	pH	EC [µS/cm]	Ca ²⁺ [mg/L]	HCO ₃ ⁻ [mg/L]	Cl ⁻ [mg/L]	NO ₃ ⁻ [mg/L]
Upper Barva - Lower Barva Flow Path 1		0.979	0.026	<0.0001	<0.0001	0.000	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Upper Barva - Lower Barva Flow Path 2		0.034	0.004	<0.0001	<0.0001	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Upper Barva - Upper Colima Flow Path 1		0.516	0.025	<0.0001	<0.0001	0.990	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Upper Barva - Upper Colima Flow Path 2		0.002	0.618	<0.0001	<0.0001	0.099	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Upper Barva - Lower Colima		0.811	0.797	<0.0001	<0.0001	0.149	<0.0001	<0.0001	<0.0001	<0.0001	0.011
Lower Barva Flow Path 1 - Lower Barva Flow Path 2		0.032	0.936	0.000	0.545	0.050	0.000	<0.0001	<0.0001	0.001	<0.0001
Lower Barva Flow Path 1 - Upper Colima Flow Path 1		0.492	0.411	0.000	0.025	<0.0001	0.000	0.852	<0.0001	<0.0001	<0.0001
Lower Barva Flow Path 1 - Upper Colima Flow Path 2		0.006	0.018	<0.0001	0.077	0.012	<0.0001	<0.0001	<0.0001	<0.0001	0.000
Lower Barva Flow Path 1 - Lower Colima		0.945	0.010	<0.0001	0.710	<0.0001	<0.0001	0.368	<0.0001	<0.0001	<0.0001
Lower Barva Flow Path 2 - Upper Colima Flow Path 1		0.002	0.289	0.625	0.011	<0.0001	0.774	<0.0001	0.873	<0.0001	<0.0001
Lower Barva Flow Path 2 - Upper Colima Flow Path 2		0.064	0.002	0.062	0.385	0.065	0.084	0.895	<0.0001	<0.0001	0.051
Lower Barva Flow Path 2 - Lower Colima		0.027	0.001	0.000	0.222	<0.0001	0.000	<0.0001	<0.0001	<0.0001	<0.0001
Upper Colima Flow Path 1 - Upper Colima Flow Path 2		0.000	0.027	0.130	0.002	0.012	0.077	<0.0001	<0.0001	0.028	<0.0001
Upper Colima Flow Path 1 - Lower Colima		0.570	0.056	0.004	0.033	0.033	0.001	0.451	<0.0001	<0.0001	0.004
Upper Colima Flow Path 2 - Lower Colima		0.003	0.464	0.204	0.068	0.000	0.183	<0.0001	0.128	<0.0001	<0.0001

Values in bold show significant differences at a p-value < 0.05.

Table S5. Silica and estimated Saturation Indexes and CO₂ (g) for groundwater in Barva and Colima multi-aquifer system, for three sampling surveys: June- 2016 (early wet season), January-2021 (late wet season), and March-2021 (dry season).

Date	Code	Aquifer	SiO ₂ (mg/L)	Aragonite	Calcite	Chalcedony	Coesite	Cristobalite	Dolomite	Magnesite	Monohydrocalcite	Quartz	SiO ₂ (am)	Tridymite	CO ₂ (g) Log fugacity
Jun-16	RN02	Upper Barva	44.1	-1.937	-1.792	0.704	0.149	0.412	-2.870	-2.766	-2.602	0.984	-0.378	0.802	-2.971
	RN08	Lower Barva	65.6	-2.152	-2.008	0.809	0.266	0.527	-3.021	-2.658	-2.834	1.083	-0.223	0.909	-1.790
	RN12	Lower Barva	80.5	-1.798	-1.654	0.889	0.345	0.606	-2.226	-2.219	-2.479	1.163	-0.146	0.989	-1.747
	RN17	Lower Barva	107.2	-1.522	-1.378	0.915	0.379	0.638	-1.660	-1.902	-2.216	1.185	-0.089	1.015	-1.470
	RN22	Lower Barva	78.9	-1.883	-1.739	0.888	0.344	0.604	-2.442	-2.350	-2.564	1.161	-0.147	0.987	-1.672
	RN29	Lower Barva	83.4	-1.823	-1.679	0.909	0.365	0.626	-2.360	-2.328	-2.504	1.183	-0.125	1.008	-1.666
	RN33	Lower Barva	81.9	-2.363	-2.219	0.833	0.296	0.555	-3.470	-2.872	-3.056	1.103	-0.172	0.933	-1.486
	RN14	Upper Colima	92.3	-1.518	-1.374	0.911	0.369	0.629	-1.674	-1.944	-2.201	1.185	-0.119	1.011	-1.749
	RN35	Upper Colima	76.5	-1.611	-1.466	0.872	0.326	0.587	-1.760	-1.949	-2.288	1.147	-0.172	0.972	-1.939
	RN43	Upper Colima	83.2	-1.636	-1.492	0.849	0.307	0.567	-1.736	-1.884	-2.321	1.122	-0.178	0.948	-1.942
	RN09	Lower Colima	76.3	-0.079	0.066	0.435	-0.110	0.151	1.450	-0.268	-0.757	0.710	-0.605	0.535	-2.838
	RN15	Lower Colima	83.8	-1.074	-0.930	0.754	0.212	0.472	-0.671	-1.383	-1.758	1.027	-0.274	0.854	-2.166
Jan-21	RN02	Upper Barva	15.52	-3.202	-3.057	0.326	-0.228	0.035	-5.426	-4.053	-3.868	0.605	-0.752	0.424	-2.417
	RN03	Upper Barva	23.60	-3.207	-3.062	0.463	-0.087	0.175	-5.074	-3.684	-3.877	0.741	-0.600	0.562	-2.065
	RN23	Upper Barva	34.30	-3.096	-2.952	0.579	0.032	0.293	-4.896	-3.602	-3.772	0.854	-0.468	0.678	-1.861
	RN01	Lower Barva	22.80	-2.521	-2.376	0.486	-0.067	0.195	-3.761	-3.067	-3.188	0.765	-0.590	0.584	-1.949
	RN06	Lower Barva	30.00	-1.976	-1.831	0.501	-0.045	0.216	-2.789	-2.610	-2.654	0.775	-0.540	0.600	-1.812
	RN08	Lower Barva	21.30	-2.415	-2.270	0.335	-0.209	0.052	-3.525	-2.902	-3.096	0.609	-0.700	0.434	-1.744
	RN12	Lower Barva	31.30	-2.160	-2.015	0.514	-0.031	0.230	-2.943	-2.578	-2.839	0.788	-0.525	0.613	-1.703
	RN17	Lower Barva	21.90	-1.351	-1.207	0.264	-0.273	-0.014	-1.311	-1.725	-2.044	0.534	-0.742	0.364	-1.666
	RN22	Lower Barva	31.50	-1.987	-1.842	0.510	-0.034	0.226	-2.642	-2.448	-2.667	0.784	-0.527	0.609	-1.728
	RN27	Lower Barva	22.90	-2.756	-2.611	0.358	-0.185	0.076	-4.174	-3.206	-3.438	0.632	-0.673	0.458	-1.700
	RN30	Lower Barva	22.90	-1.570	-1.425	0.354	-0.189	0.072	-1.770	-1.988	-2.252	0.627	-0.676	0.453	-1.475
	RN33	Lower Barva	28.40	-1.781	-1.637	0.403	-0.136	0.123	-2.306	-2.299	-2.470	0.674	-0.612	0.503	-1.886
	RN35	Upper Colima	33.00	-1.679	-1.534	0.545	-0.001	0.260	-1.914	-2.034	-2.356	0.820	-0.499	0.644	-2.092
	RN36	Upper Colima	33.10	-1.443	-1.299	0.486	-0.056	0.205	-1.278	-1.618	-2.128	0.759	-0.540	0.586	-2.176
	RN45	Upper Colima	37.20	-1.666	-1.521	0.574	0.030	0.290	-1.969	-2.094	-2.347	0.847	-0.461	0.673	-1.735
	RN09	Lower Colima	31.60	-0.869	-0.725	0.494	-0.053	0.208	-0.125	-1.060	-1.544	0.770	-0.556	0.593	-2.365
	RN42	Lower Colima	34.30	-1.043	-0.899	0.467	-0.075	0.185	-0.566	-1.306	-1.728	0.740	-0.560	0.567	-2.383
	RN47	Lower Colima	31.80	-1.245	-1.101	0.470	-0.071	0.189	-0.835	-1.374	-1.929	0.743	-0.556	0.570	-2.064

Date	Code	Aquifer	SiO ₂ (mg/L)	Aragonite	Calcite	Chalcedony	Coesite	Cristobalite	Dolomite	Magnesite	Monohydrocalcite	Quartz	SiO ₂ (am)	Tridymite	CO ₂ (g) Log fugacity
Mar-21	RN02	Upper Barva	35.9	-2.812	-2.668	0.684	0.130	0.393	-4.656	-3.673	-3.478	0.964	-0.394	0.782	-2.567
	RN03	Upper Barva	48.9	-2.997	-2.853	0.766	0.216	0.478	-4.661	-3.476	-3.669	1.043	-0.293	0.865	-2.231
	RN23	Upper Barva	54.5	-2.788	-2.643	0.755	0.210	0.471	-4.254	-3.261	-3.467	1.030	-0.284	0.855	-1.898
	RN01	Lower Barva	57.2	-1.639	-1.494	0.790	0.238	0.500	-2.013	-2.197	-2.307	1.069	-0.281	0.889	-2.490
	RN06	Lower Barva	65.3	-2.187	-2.042	0.832	0.287	0.548	-3.022	-2.632	-2.865	1.107	-0.209	0.932	-1.842
	RN27	Lower Barva	51.1	-2.366	-2.221	0.710	0.167	0.427	-3.404	-2.829	-3.047	0.984	-0.324	0.810	-1.861
	RN08	Lower Barva	50.6	-2.190	-2.045	0.725	0.180	0.441	-3.101	-2.709	-2.868	1.000	-0.316	0.825	-1.981
	RN12	Lower Barva	67.6	-1.785	-1.641	0.824	0.280	0.540	-2.207	-2.217	-2.464	1.099	-0.215	0.924	-1.928
	RN17	Lower Barva	95.4	-1.252	-1.108	0.849	0.311	0.570	-1.136	-1.656	-1.942	1.120	-0.163	0.949	-1.762
	RN22	Lower Barva	71.5	-1.915	-1.770	0.844	0.300	0.561	-2.513	-2.390	-2.596	1.118	-0.190	0.943	-1.828
	RN30	Lower Barva	70.1	-2.284	-2.139	0.859	0.314	0.575	-3.223	-2.735	-2.963	1.134	-0.180	0.958	-1.752
	RN33	Lower Barva	64.8	-2.199	-2.055	0.756	0.217	0.477	-3.152	-2.725	-2.889	1.027	-0.258	0.856	-1.732
	RN40	Lower Barva	73.7	-1.689	-1.544	0.842	0.299	0.560	-2.138	-2.240	-2.370	1.116	-0.191	0.942	-1.895
	RN07	Upper Colima	58.7	-2.369	-2.224	0.759	0.216	0.476	-3.388	-2.807	-3.051	1.032	-0.272	0.858	-1.923
	RN35	Upper Colima	69.1	-2.329	-2.185	0.841	0.297	0.558	-3.226	-2.688	-3.010	1.115	-0.194	0.940	-1.785
	RN36	Upper Colima	92.8	-2.154	-2.009	0.927	0.386	0.646	-2.708	-2.338	-2.838	1.200	-0.099	1.027	-1.748
	RN14	Upper Colima	77.2	-1.893	-1.749	0.881	0.337	0.598	-2.445	-2.343	-2.574	1.155	-0.154	0.980	-1.685
	RN43	Upper Colima	69.8	-1.562	-1.417	0.813	0.267	0.528	-1.550	-1.786	-2.240	1.088	-0.229	0.912	-2.047
	RN45	Upper Colima	78.1	-1.499	-1.355	0.836	0.293	0.553	-1.592	-1.880	-2.182	1.109	-0.195	0.935	-1.885
	RN09	Lower Colima	68.6	-1.906	-1.762	0.841	0.296	0.557	-2.195	-2.085	-2.585	1.116	-0.199	0.940	-1.726
	RN15	Lower Colima	73	-1.919	-1.774	0.843	0.300	0.560	-2.361	-2.233	-2.600	1.117	-0.190	0.942	-1.826
	RN42	Lower Colima	68.8	-1.499	-1.354	0.753	0.211	0.471	-1.499	-1.783	-2.184	1.025	-0.272	0.852	-2.055
	RN47	Lower Colima	79.1	-1.508	-1.364	0.805	0.264	0.524	-1.371	-1.644	-2.193	1.078	-0.219	0.905	-1.954

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