SUPPLEMENTARY MATERIAL TO

Assessment of the main geochemical processes affecting surface water and groundwater in a low-lying coastal area: implication for water management

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Table S1. Database of the samples with specified name, coordinates, and sampling depths.

N°	Sample name	East UTM ED50	North UTM ED50	depth (m a.s.l.)	N°	Sample name	East UTM ED50	North UTM ED50	depth (m a.s.l.)
1	1_P10N-1	759592	4932644	-0.42	53	3_P15N-2	754506	4926583	-3.05
2	1_P10N-2	759592	4932644	-4.02	54	3_P15N-3	754506	4926583	-5.55
3	1_P10N-3	759592	4932644	-8.02	55	3_P15N-4	754506	4926583	-10.55
4	1_P13N-1	761766	4927310	-0.89	56	3_P15N-5	754506	4926583	-15.55
5	1_P13N-2	761766	4927310	-6.49	57	3_P16S-1	766100	4912892	-3.21
6	1_P2N-1	760668	4933233	-0.76	58	3_P16S-2	766100	4912892	-5.21
7	1_P2N-2	760668	4933233	-3.01	59	3_P16S-3	766100	4912892	-7.21
8	1_P2N-3	760668	4933233	-7.01	60	3_P16S-4	766100	4912892	-14.21
9	1_P9N-1	760437	4932363	-0.82	61	3_P17S-1	764292	4912790	-1.06
10	1_P9N-2	760437	4932363	-4.82	62	3_P17S-2	764292	4912790	-5.86
11	1_P9N-3	760437	4932363	-9.82	63	3_P17S-3	764292	4912790	-9.86
12	1_P2S-1	764729	4917882	-1.74	64	3_P17S-4	764292	4912790	-14.36
13	1_P2S-2	764729	4917882	-4.04	65	3_P3N-1	760381	4938527	-3.47
14	1_P2S-3	764729	4917882	-6.54	66	3_P3N-2	760381	4938527	-7.47
15	1_P2S-4	764729	4917882	-17.54	67	3_P3S-1	762751	4917607	-2.00
16	1_P2S-5	764729	4917882	-22.54	68	3_P3S-2	762751	4917607	-7.50
17	2_P13S-1	761463	4914638	-2.33	69	3_P3S-3	762751	4917607	-10.70
18	2_P13S-2	761463	4914638	-5.33	70	3_P3S-4	762751	4917607	-16.50
19	2_P13S-3	761463	4914638	-11.33	71	3_P3S-5	762751	4917607	-20.50
20	2_P13S-4	761463	4914638	-16.33	72	3_P6S-1	758429	4916490	-3.10
21	2_P12S-1	762568	4915303	-0.88	73	3_P6S-2	758429	4916490	-9.10
22	2_P12S-2	762568	4915303	-4.38	74	3_P6S-3	758429	4916490	-15.10
23	2_P12S-3	762568	4915303	-8.38	75	3_P9S-1	754369	4916655	1.09
24	2_P12S-4	762568	4915303	-12.88	76	3_P9S-2	754369	4916655	0.39
25	2_P4S-1	761715	4917496	-1.11	77	3_P14N-4	760792	4926497	-24.13
26	2_P4S-2	761715	4917496	-8.11	78	4_CAV	749304	4927967	-0.10
27	2_P4S-3	761715	4917496	-14.11	79	4_EMS1-1	757954	4916761	-6.00
28	2_P4S-4	761715	4917496	-16.11	80	4_EMS1-2	757954	4916761	-9.50
29	2_P4S-5	761715	4917496	-21.11	81	4_EMS1-3	757954	4916761	-18.50
30	2_P5S-1	760383	4917138	-1.57	82	4_EMS-1	757675	4916916	-0.10
31	2_P5S-2	760383	4917138	-5.07	83	4_EMS-2	757675	4916916	-0.10
32	2_P5S-3	760383	4917138	-9.07	84	4_EMS-3	757675	4916916	-0.10
33	2_P5S-4	760383	4917138	-13.07	85	4_P10S-1	759209	4915518	-3.90
34	2_P5S-5	760383	4917138	-18.07	86	4_P10S-2	759209	4915518	-8.90
35	2_P4N-1	758447	4938727	-1.18	87	4_P10S-3	759209	4915518	-13.40
36	2_P4N-2	758447	4938727	-2.28	88	6.1_L1	759673	4935495	-0.10
37	2_P4N-3	758447	4938727	-7.28	89	6.1_L2	761065	4928476	-0.10
38	2_P4N-4	758447	4938727	-9.78	90	6.1_L3	757618	4930944	-0.10
39	2_P4N-5	758447	4938727	-28.28	91	6_Lmix_3	757711	4930671	-0.10
40	2_PZSV10-1	756657	4932041	-0.01	92	6_Lmix_1	757560	4934025	-0.10
41	2_PZSV10-2	756657	4932041	-3.51	93	6_Lmix_2	757527	4932815	-0.10
42	2_PZSV9-1	757177	4932025	-0.73	94	7_3P	755407	4927697	-0.10
43	2_PZSV9-2	757177	4932025	-3.43	95	7_FG	759215	4916511	-0.10
44	3_PR4	764193	4918702	-1.15	96	7_CE	752822	4930325	-0.10
45	3_P11N-1	753140	4932514	-0.61	97	7_DX RE	751938	4935849	-0.10
46	3_P11N-2	753140	4932514	-5.61	98	7_BEVANELLA	762360	4913799	-0.10
47	3_P11N-3	753140	4932514	-13.61	99	8_CER	747703	4907413	-0.10
48	3_P14S-1	762477	4913842	-0.70	100	8_BEV	761602	4913346	-0.10
49	3_P14S-2	762477	4913842	-7.80	101	8_FU	756154	4921279	-0.10
50	3_P14S-3	762477	4913842	-13.30	102	8_LAM	752195	4933007	-0.10
51	3_P14S-4	762477	4913842	-20.30	103	8_RE	758437	4941589	-0.10
52	3_P15N-1	754506	4926583	-1.55	104	8_SAVIO	762937	4911294	-0.10

Table S2. Descriptive statistics of major elements and ratios of all samples. "d.l." means detection limit.

	d.l.	Unit	n° obs.	Obs.>d.l.	Mean	St.Dev.	Min	25°	Median	75°	Max
Salinity		g/l	104	104	9.5	8.0	0.1	3.1	7.9	14.5	33.0
pH			104	104	7.6	0.9	5.9	7.4	7.6	8.3	9.9
Eh (mV)		mV	104	104	-70	116	-409	-157	-80	-2	361
O_2		mg/L	98	98	4.8	3.1	0.3	2.4	4.1	6.2	12.5
H_2S	0.01	mg/L	12	11	0.028	0.041	<0.001	0.008	0.016	0.029	0.149
Na^+		mg/L	104	104	3173	3048	2	709	2319	5114	12690
K^+		mg/L	104	104	101	99	2	30	59	145	399
Ca^{2+}		mg/L	104	104	209	121	30	125	180	258	571
Mg^{2+}		mg/L	104	104	437	382	11	146	313	623	1676
Cl^-		mg/L	104	104	6014	5832	20	1507	4214	9345	24917
NO_3^-		mg/L	104	104	8.8	18.4	1.3	1.3	1.3	4.4	117.0
SO_4^{2-}		mg/L	104	104	601	633	1	160	355	821	2715
HCO_3^-		mg/L	104	104	686	302	188	483	650	838	1618
Br^-		mg/L	104	104	25	29	1	1	12	43	130
SO_4^{2-}/Cl^- eq			104	102	0.3269	0.7817	0.0001	0.0643	0.0973	0.2153	6.4149
Cl^-/Br^- molar			104	104	3007	8292	38	292	602	670	44836

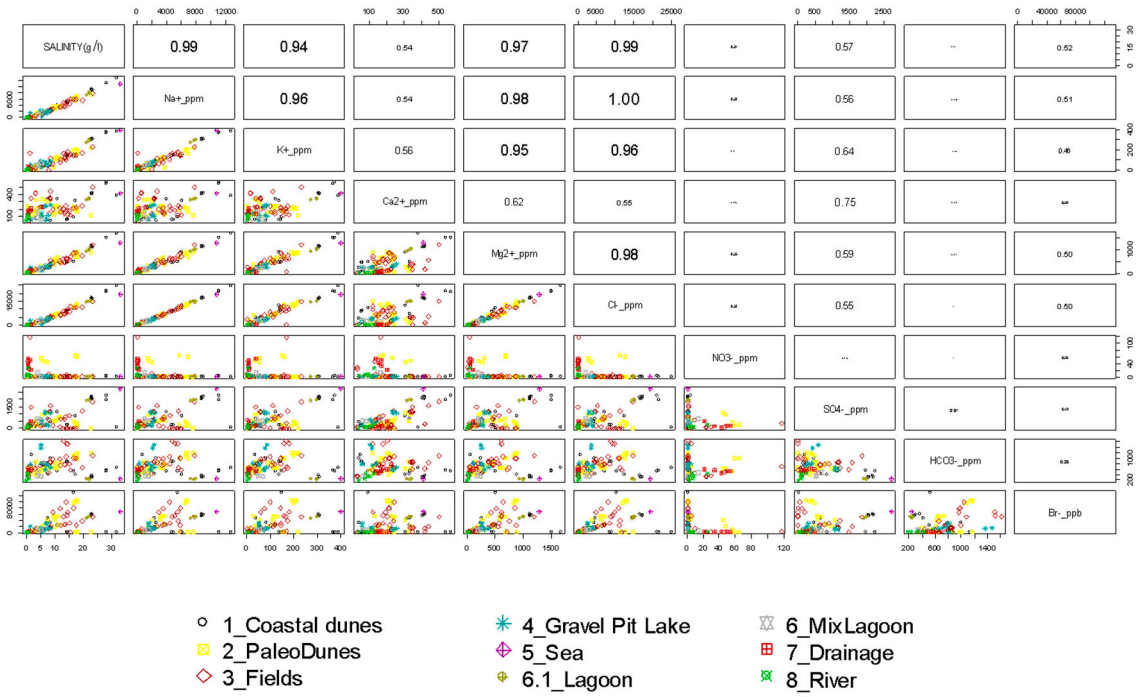

Figure S1. Matrix of correlation coefficients for major elements with salinity, grouped by environments as by Mollema et al.

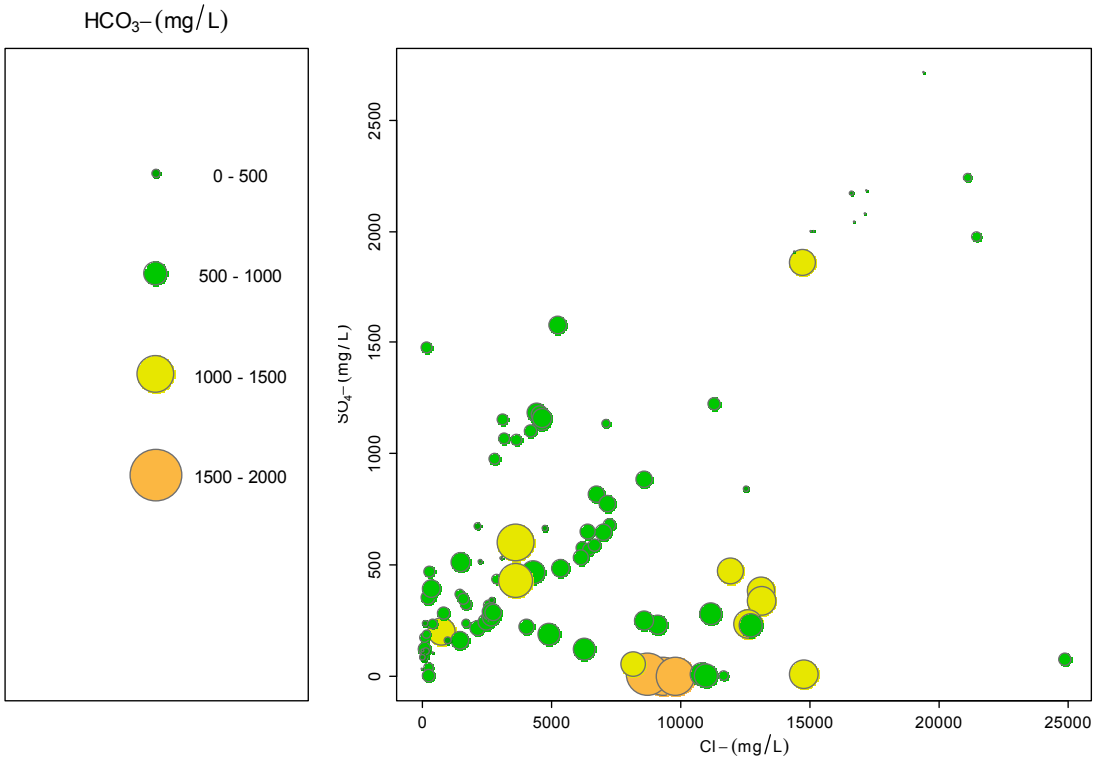

Figure S2 Binary plot of SO42- versus Cl- of all water samples. The symbol size is proportional to HCO3- concentration as indicated in legend on the left-hand side.

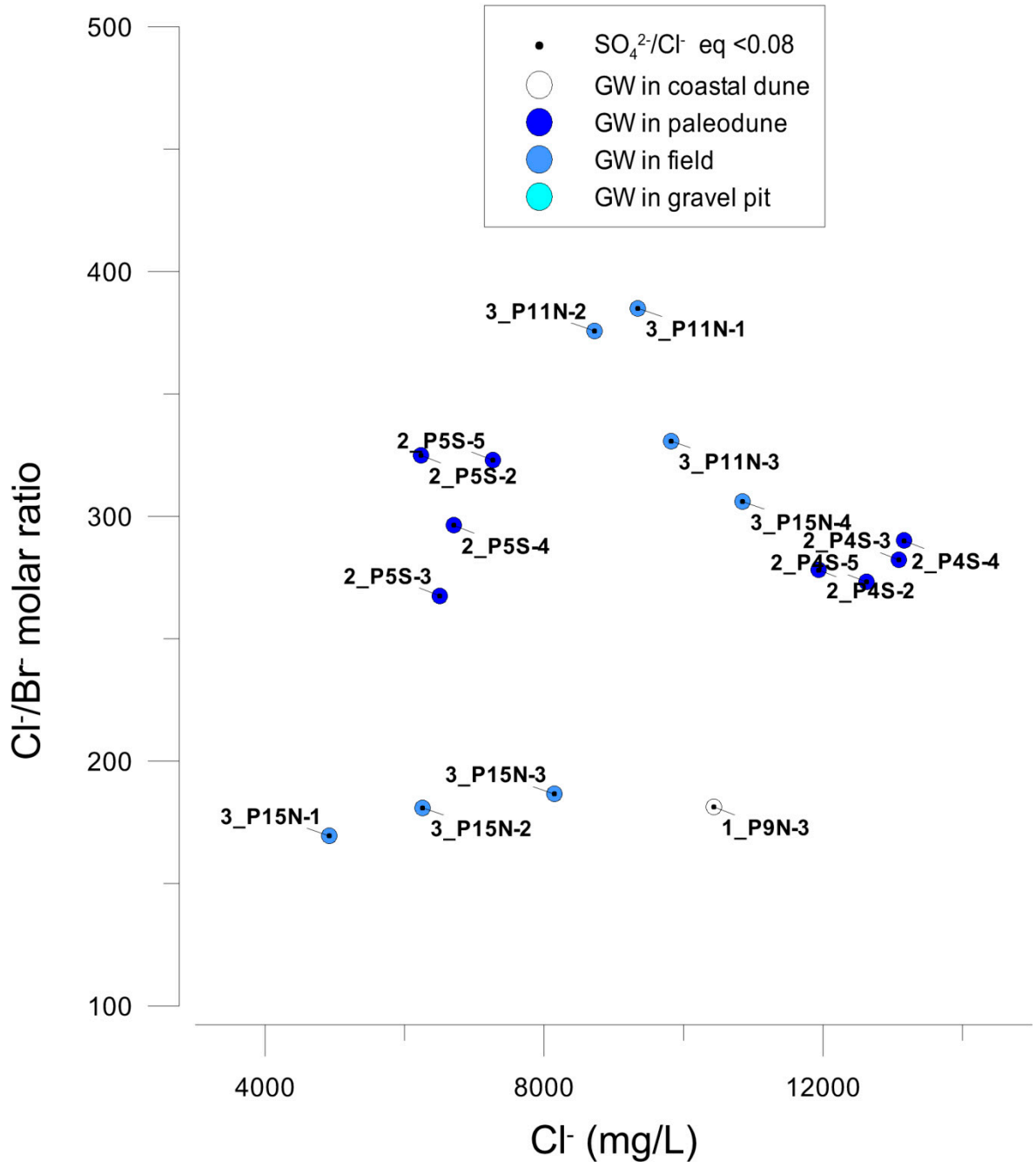

Figure S3. Zoom of Figure 6 showing the water samples indicating both low Cl^-/Br^- molar ratio and organic matter degradation.

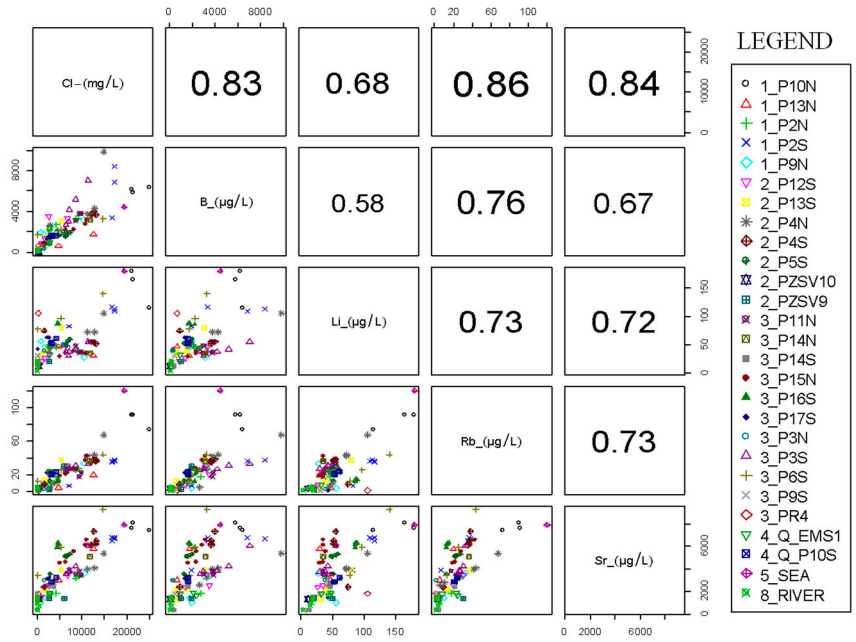

Figure S4. Correlation coefficient matrix of Cl^-, B, Li, Rb, and Sr concentrations for all GW samples keeping rivers and sea as end members.

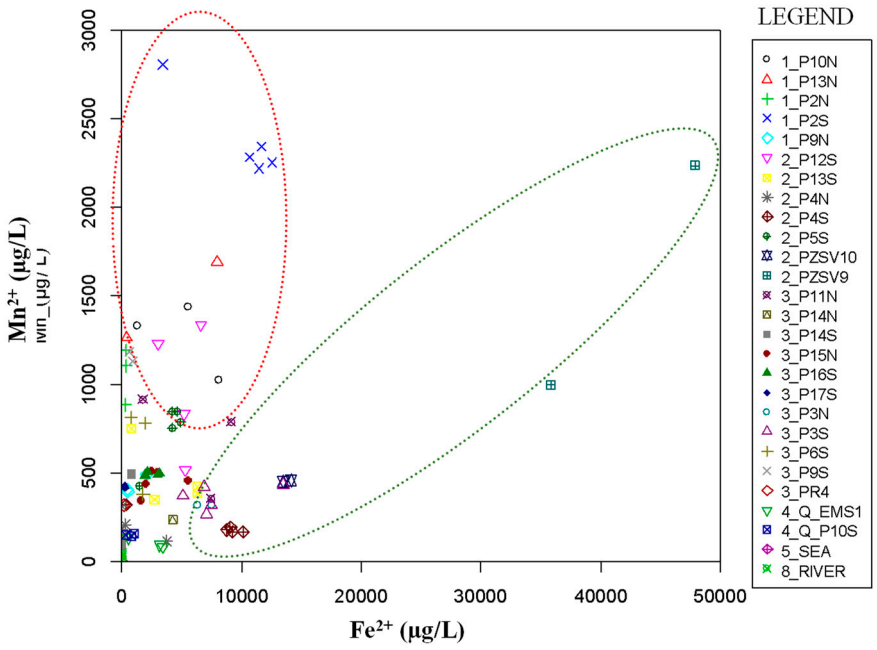

Figure S5. Scatterplot of Fe vs Mn for groundwater samples. Red dotted line indicates palaeodunes samples with Mn enrichments and contemporary low Fe concentration. At the opposite, green dotted line indicates samples from paleodunes and field environment with higher Fe concentration.

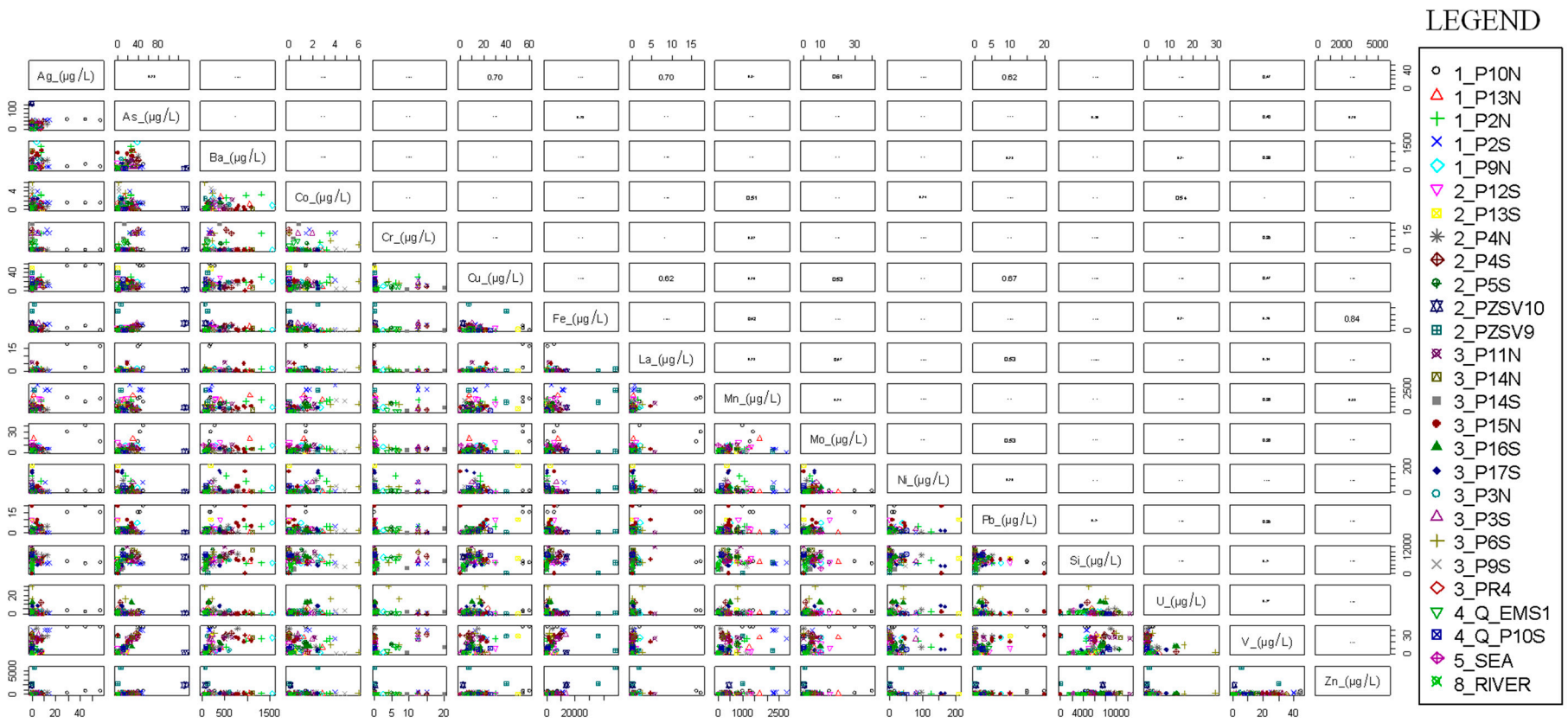

Figure S6. Correlation coefficients matrix for TEs deriving by water-sediment interaction for all groundwater samples.

Table S3. Summary statistics for the six wells (P2S, P4S, P11N, P15N, P6S, P14S), which are selected to represent the main geochemical processing occurring in the study area.

Well		P2S	P2S	P2S	P2S	P2S	P4S	P4S	P4S	P4S	P4S	P11N and P15N	P11N and P15N	P11N and P15N	P11N and P15N	P11N and P15N	P6S	P6S	P6S	P6S	P6S	P14S	P14S	P14S	P14S	P14S
Stat		Mean	S.D.	Median	Min	Max	Mean	S.D.	Median	Min	Max	Mean	S.D.	Median	Min	Max	Mean	S.D.	Median	Min	Max	Mean	S.D.	Median	Min	Max
Eh	mV	-119	52	-141	-157	-28	-54	76	-178	-177	31	-209	92	-179	-409	-119	-90	92	-70	-190	-10	-37	4	-36	-43	-34
Cl^-	mg/L	14977	4387	16748	7143	17199	10467	5028	12627	1515	13161	8636	2144	9034	4922	11024	6722	7390	5264	170	14733	1053	1759	183	154	3691
HCO_3^-	mg/L	352	93	297	291	509	1081	132	1139	852	1168	1199	291	1018	962	1618	829	247	833	580	1073	367	55	349	323	446
SO_4/ Cl eq		0.097	0.012	0.094	0.089	0.117	0.112	0.082	0.022	0.029	0.249	0.006	0.010	0.000	0.000	0.028	2.243	3.613	0.221	0.093	6.415	0.373	0.178	0.420	0.119	0.533
Cl/B molar		662	37	657	613	711	550	156	282	278	677	369	277	318	169	1019	524	190	614	306	652	401	181	329	277	670
Mn	µg/L	2382	242	2284	2220	2808	638	460	174	192	1337	539	204	482	344	913	657	240	779	381	812	194	199	102	81	491
Fe	µg/L	9955	3708	11475	3425	12525	5308	3196	9100	335	9100	4079	2902	2700	1550	9125	1517	644	1800	780	1970	213	379	36	0	780
Ba	µg/L	164	24	166	132	197	298	137	497	130	477	767	215	779	472	1075	168	105	208	49	247	157	149	85	77	379
Si	µg/L	4675	198	4600	4550	5025	6156	1234	7725	4735	7600	6919	3626	6250	<40	12400	7677	2537	8060	4970	10000	2869	1929	2018	1700	5740
Ag	µg/L	8.9	5.6	11.0	1.5	14.8	4.7	4.4	<0.05	<0.05	9.5	3.2	3.2	3.1	<0.05	8.8	<0.05		<0.05	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05
As	µg/L	40.5	10.2	45.0	22.5	47.5	17.1	15.0	37.5	<0.5	37.5	22.5	9.8	27.5	<0.5	30.0	18.5	17.5	15.0	3.0	37.5	8.4	5.0	8.7	2.2	14.0
Co	µg/L	2.1	1.1	1.5	1.5	4.0	0.6	0.8	<0.02	<0.02	1.6	0.6	0.7	0.5	<0.02	2.3	3.2	3.0	3.6	<0.02	6.0	0.5	0.2	0.4	0.4	0.8
Cr	µg/L	13.0	1.1	12.5	12.5	15.0	<0.5		<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	7.8	4.3	7.0	4.0	12.5	7.6	9.2	5.0	0.5	20.0
Cu	µg/L	14.5	4.5	12.5	12.5	22.5	15.2	9.4	7.5	7.5	30.0	14.4	7.8	17.5	<0.1	22.5	16.7	4.5	16.0	12.5	21.5	4.2	1.5	4.2	2.4	6.0
La	µg/L	0.3	0.3	0.3	<0.01	0.5	0.4	0.4	<0.01	<0.01	1.0	1.5	2.4	0.1	<0.01	5.8	1.1	1.2	0.5	0.2	2.5	0.0	0.0	0.0	<0.01	0.1
Mo	µg/L	4.0	2.2	5.0	<0.1	5.0	7.9	5.3	5.0	1.0	15.0	5.0	3.5	5.0	<0.1	10.0	3.3	3.5	3.0	<0.1	7.0	3.4	0.7	3.4	2.6	4.0
Ni	µg/L	18.5	34.8	<0.2	<0.2	80.0	7.7	12.8	<0.2	<0.2	29.5	34.4	54.3	8.8	<0.2	160.0	27.3	23.7	41.0	<0.2	41.0	7.1	5.7	4.7	3.4	15.5
Pb	µg/L	1.0	2.2	<0.1	<0.1	5.0	3.1	4.1	<0.1	<0.1	10.0	6.3	6.5	5.0	<0.1	20.0	1.2	1.0	1.5	<0.1	2.0	1.1	1.3	0.6	<0.1	3.0
Sb	µg/L	<0.05		<0.05	<0.05	<0.05	0.1	0.2	<0.05	<0.05	0.4	<0.05		<0.05	<0.05	<0.05	0.2	0.3	<0.05	<0.05	0.5	0.3	0.2	0.3	<0.05	0.4
U	µg/L	0.9	0.3	0.8	0.8	1.5	2.7	5.6	<0.02	<0.02	12.7	0.4	0.7	<0.02	<0.02	<0.02	16.1	13.6	16.1	2.5	29.7	2.0	0.5	1.9	1.6	2.8
V	µg/L	37.0	6.7	40.0	25.0	40.0	12.9	9.7	30.0	4.5	27.5	25.6	3.2	26.3	20.0	30.0	17.3	16.6	15.0	2.0	35.0	4.5	5.1	2.5	1.0	12.0
Zn	µg/L	333.5	129.6	400.0	192.5	462.5	88.7	28.0	75.0	45.0	122.5	91.6	44.1	96.3	<0.5	150.0	140.5	81.0	95.0	92.5	234.0	31.5	16.7	35.4	7.9	47.2
B	µg/L	4795	2713	3400	1950	8400	2541	1313	3675	880	3675	2846	756	2925	1620	3825	2420	805	2240	1720	3300	680	627	375	349	1620
Li	µg/L	108	15	113	83	118	47	19	55	27	75	37	5	35	30	48	105	32	97	77	140	21	17	13	12	46
Rb	µg/L	31	13	37	7	38	21	12	36	9	35	27	9	25	18	43	28	16	26	13	44	9	9	4	4	22
Sr	µg/L	6097	1239	6643	3890	6770	3355	1610	6228	2345	6120	4738	1211	4557	3360	6603	6176	2910	5892	3418	9218	847	1012	356	312	2364

Reference

1. Mollema, P.; Antonellini, M.; Dinelli, E.; Gabbianelli, G.; Greggio, N.; Stuyfzand, P. Hydrochemical and physical processes influencing salinization and freshening in Mediterranean low-lying coastal environments. *Appl. Geochem.* **2013**, *34*, 207–221, doi:10.1016/j.apgeochem.2013.03.017.