

Chemical evolution of saline waters in the Jordan-Dead Sea transform and in adjoining areas

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Unfortunately, in the original version of this article Table 1 is incomplete. The first column is missing. The complete table can be found in the following pages.

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Table 1 Chemical and isotopic composition of regionally grouped formation waters

Location in Fig. 2	Location	Sample origin	Data source	Hosting formations	T (°C)	pH	Na (mg/L)	K (mg/L)	Mg (mg/L)	Ca (mg/L)	Cl (mg/L)	Br (mg/L)	SO ₄ (mg/L)	HCO ₃ (mg/L)	SiO ₂ (mg/L)	δ ¹⁸ O (‰)	δ ² H (‰)	TDS (mg/L)	
LAKE KINNERET AREA																			
1	Rosh Pina 1	W	2	Jur.			33,415	1,157	2,918	26,946	105,349	1,742	347	171					171,873
1	Rosh Pina 1	W	2	Jur.			8,004	358	724	4,794	22,819		1,161	370					37,859
1	Rosh Pina 1	W	1	Jur.			33,400	1,160	2,920	27,000	105,000	1,740	700	171					171,920
1	Kalanit 2	W	1	U. Cret.	25.5	7.2	17.6	1.8	33	79	30	0.1	8	464	13	-5.2	-25	182	
3	Huqoq well	W	1	U. Cret.	18.6	7.2	42.5	2.7	29	77	90	0.2	1.3	357	22	-4.8	-22	275	
<i>Tabgha cluster</i>																			
4	Tabgha-Druzi Spring	S	1	U. Cret.	18.3	7.6	670	29.1	85	305	1,437	15.3	140	219	14	-3.1	-17	2,695	
4	Tabgha-Druzi Spring	S	3	U. Cret.			579	21.7	70	249	1,280	12.5	107	269	15	-5.9	-30	2,319	
5	Tabgha-En Sheva	S	1	Tert.	23.9	7.1	293	12.1	42	170	690	7.24	56	259	15	-5.9	-30	1,286	
5	Tabgha-En Sheva	S	3	Tert.			493	19.1	62	249	1,110	10.6	87	291	13	-5.4	-27	2,031	
6	Tabgha-Sartan spring (saline)	S	1	U. Cret.	28.8	6.9	1,274	51.4	149	518	3,000	28.1	245	325	15	-5.5	-26	5,278	
6	Tabgha-Sartan spring (saline)	S	3	U. Cret.			1,420	51.8	146	501	3,200	26.5	259	304	15	-5.5	-26	5,604	
7	Tabgha-Sartan spring (fresh)	S	1	Tert.	27.8	6.8	812	31.2	92	330	1,930	17.6	143	287	16	-5.9	-31	3,371	
7	Tabgha-Sartan spring (fresh)	S	3	Tert.			741	29.2	85	316	1,770	15.9	140	266	16	-5.9	-31	3,097	
8	Tabgha-well Kinneret 7	W	1	U. Cret.	23.2	7.1	139	6.6	24	123	320	2.55	29	265	16	-5.9	-31	660	
8	Tabgha-well Kinneret 7	W	3	U. Cret.			317	12.7	42	189	741	6.93	55	286	16	-5.9	-31	1,364	
9	Tabgha-well Kinneret 8	W	1	U. Cret.	27.8	7.0	7,296	260	466	1,742	15,490	120	706	17	0	-2.3	-11	26,080	
10	Barbutim well	W + L	1	Quat.	23	6.9	1,103	73.9	132	448	2,662	22.3	203	346	13			4,658	
<i>Fuliya cluster</i>																			
11	Fuliya-spring	S	1	U. Cret.	28.4	7.0	374	12.1	65	167	755	4.49	98	313	21	-5	-22	1,497	
12	Fuliya-well D 906	W	1	U. Cret.	25	7.2	186	4	46	111	432	2.6	58	312	15	-4.9	-23	854	
13	Fuliya-well A	W	1	U. Cret.	28	8.7	1,111	40	86	129	2,169	15.2	4	48	0	-4	-11	3,554	
14	Fuliya-well B	S	1	U. Cret.	28.1	7.0	475	20.3	81	212	987	6.3	191	326	22	-4.9	-22	1,994	
15	Fuliya-well Kinneret 5	W	1	U. Cret.	25	8.0	1,869	67.4	181	426	4,271	28.1	295	35	2	-4.1	-21	7,140	
16	Fuliya-6	W	3				352	11.2	64	151	720	3.91	93	314	2			1,395	
16	Fuliya-well 6/2	W	3				450	15	73	178	939	5.71	121	310	13			1,782	
17	Fuliya-well Kinneret 10 B	W	1	U. Cret.	27	8.9	8,044	306	748	1,856	17,213	124	1,606	21		-1.4	-5.1	29,896	
<i>Tiberias Hot Spring cluster</i>																			
18	Tiberias, Kikar well	W	1	U. Cret.	40.8	7.3	10,540	491	1,093	5,157	29,746	484	474	40	12	2.64	26.6	47,997	
19	Tiberias Hot Springs-Main Spring	S	1	U. Cret.	59	6.0	7,197	333	655	3,418	18,810	241	796	197	28	-3.2	-18	31,478	
19	Tiberias Hot Springs-Main Spring	S	3	U. Cret.			6,940	325	662	3,400	18,300	238	812	143				30,677	
19	Tiberias Hot Springs-Main Spring	S	3	U. Cret.			6,800	316	651	3,330	18,000	230	788	140				30,115	
20	Jordan-2	W	2	L. Cret.			1,436	19.9	24	40	1,584		227	912				3,330	
20	Jordan-1	W	2	L. Cret.			6,080	257	377	1,407	11,413		2,188	250				21,721	
21	Tiberias Hot Springs-Roman Spring	S	1	U. Cret.	57.5	6.4	6,335	336	639	3,403	19,018	252	755	135	35			30,773	
21	Tiberias Hot Springs-Roman Spring	S	3	U. Cret.			7,050	326	666	3,480	18,400	240	808	138				30,970	
<i>Eastern Shore of Lake Kinneret</i>																			
22	Bet Zaida, well	W	3	Quat.			3,580	35.3	857	724	9,680	123	11	185				15,010	
23	Gofra spring	S	1	Quat.	25.5	7.6	1,187	71.5	213	230	2,522	36.4	98	436	33	-4.3	-21	4,391	
24	Ha'On beach, well	W	1	Quat.	24.2	6.6	5,212	442	1,657	1,078	15,800	202	60	504	53	-2	-12	24,504	

Table 1 continued

Location in Fig. 2	Location	Sample origin	Data source	Hosting formations	T (°C)	pH	Na (mg/L)	K (mg/L)	Mg (mg/L)	Ca (mg/L)	Cl (mg/L)	Br (mg/L)	SO ₄ (mg/L)	HCO ₃ (mg/L)	SiO ₂ (mg/L)	δ ¹⁸ O (‰)	δ ² H (‰)	TDS (mg/L)	
YARMUQ GORGE																			
<i>Northern side</i>																			
25	Yarmuq Gorge-En Reah	S	1	Tert.	38	6.9	143	12.2	40	142	309	4.2	115	362	20	-5.8	-30	786	
26	Yarmuq Gorge-En Makla	S	1	Tert.	47.3	6.6	212	18	44	178	488	6.2	158	340	26	-6	-32	1,131	
27	Yarmuq Gorge-Meizar well 2	W	1	U. Cret.	60	6.6	178	21.8	35	142	317	3.7	278	244	38	-6.8	-33	1,013	
28	Yarmuq Gorge-Meizar well 3	W	1	U. Cret.	41.8	7.1	49	4.7	21	65	62	0.30	4	315	23	-5.9	-29	228	
<i>Southern side</i>																			
29	Yarmuq Gorge-Bir Mukheiba 8	W	1	U. Cret.	29.1	7.0	39	3.1	30	91	57	0.30	54	357	16	-5.7	-27	291	
30	Yarmuq Gorge-Mukheiba	W	4	U. Cret.	44.3	4.3	43	5.3	46	86	62	78	400	400	25	-6.1	-32	320	
31	Himma	S	1	U. Cret.	41.5	7.1	124	13.9	35	108	208	2.3	148	337	25	-6.1	-32	664	
CENTRAL JORDAN VALLEY																			
<i>Western side</i>																			
32	Zemah 1	W	3	Quat.	79.274	7.8	100	2	31	1,200	119,813	54	7,978	110	40	-3.9	-10	208,521	
33	Devora 1	W	2	U. Cret.	759	7.8	100	2	31	216	1,633	211	211	354	40	-3.9	-10	2,965	
33	Devora-2A	W	2	Tr.	40,204	7.8	100	2	31	34,820	129,540	2,102	192	427	40	-3.9	-10	209,203	
34	Bira 2	W	1	Neog.	25.2	7.8	100	2	31	37	111	0.4	36	233	40	-3.9	-10	357	
35	Newe Ur	W	1	Quat.	29.2	8.0	258	14	22	21	179	0.8	95	364	32	-3.6	-14	620	
36	Bet Yosef	W	1	Neog.	31.1	7.7	569	51.8	64	48	665	4.4	484	260	28	-3.2	-11	1,914	
37	En Huga	S	1	Tert.	25	7.6	764	24.8	169	256	1,716	9.4	303	316	25	-3	-12	3,268	
38	En Amal	S	1	U. Cret.	28.2	7.1	498	11.8	94	176	1,076	6.5	136	310	20	-4.9	-19	2,017	
39	En Moda	S	1	U. Cret.	26.3	7.1	98	3.2	43	102	250	1	45	361	20	-5.2	-21	561	
40	Hammam el Malih 1	S	1	Jur.	35.1	7.0	755	44.5	103	380	1,730	23.8	343	257	20	-5.1	-21	3,399	
41	Beqaot 2	W	1	U. Cret.	31.1	7.3	85	4	34	59	135	1.8	37	245	20	-5.1	-21	376	
42	Beqaot 1	W	1	U. Cret.	28.9	7.3	55	3.1	33	59	103	1.2	31	267	19	-5.2	-22	306	
43	20-17/11	W	1	Cret.-Tert.	29.2	7.0	495	36.7	171	202	1,248	21.8	313	249	27	-4.8	-23	2,514	
44	Argaman 14	W	1	Cret.-Tert.	30	7.2	156	13.4	46	73	304	4.6	61	245	19	-4.9	-21	677	
45	Argaman 29	W	1	Cret.-Tert.	29.7	7.2	225	16.4	71	97	472	8.4	108	259	21	-4.8	-21	1,019	
46	Fazael 2	W	1	U. Cret.	25.3	7.3	26	1.9	26	57	49	0.2	14	267	16	-5.5	-24	190	
47	Fazael 6	W	1	U. Cret.	26.1	7.3	57	4.6	38	68	154	3.7	16	228	15	-5.6	-23	357	
48	Fazael 8	W	1	U. Cret.	28.5	7.3	89	6.8	50	79	238	6.6	22	230	15	-5.6	-23	505	
49	Jericho 2 (salty)	W	2	L. Cret.	26.0	5.560	490	641	641	1,115	12,199	220	868	91	13	-5.6	-24	264	
50	Mitspe Jericho 2	W	1	U. Cret.	24.3	7.2	39	2.8	31	75	72	0.4	31	264	13	-5.6	-24	264	
<i>Eastern side</i>																			
51	Adasiya	W	4	Quat.	28	271	9.44	58	58	102	380	229	217	217	20	-5.7	-28	1,050	
52	N-Shuna	W	4	U. Cret.	23.8	127	7.2	69	69	152	181	258	400	400	20	-5.7	-28	795	
52	Shuna, north 1,010 m	S	1	U. Cret.	54.8	6.8	84	4.2	50	70	120	0.60	70	406	20	-5.7	-28	418	
53	JICA well 3	W	4	Quat.	27.5	1.187	117	158	158	670	1,928	1,822	1,003	1,003	16	-5.7	-27	5,882	
54	Manshiya 2	W	1	L. Cret.	48.8	6.9	29	1.9	37	64	35	40	348	348	16	-5.7	-27	223	
54	Manshiya well	W	4	L. Cret.	52	30	1.6	41	41	76	47	46	372	372	18	-5.8	-28	242	
55	Waqqaq	W	1	U. Cret.	49.4	32	3.1	37	37	64	44	0.10	27	363	18	-5.8	-28	224	
55	Waqqaq well	W	4	U. Cret.	52	41	3.12	39	39	88	55	60	396	396	25	-5.8	-28	285	
56	Wadi Ziglab	W	4	Quat.	24.3	51	3.9	50	50	88	99	74	393	393	18	-5.8	-28	367	
57	Teibeh	W	4	Quat.	41	41	3.9	41	41	56	78	115	192	192	18	-5.8	-28	336	
58	Rajib	W	4	Quat.	102	8.97	76.9	140	140	54	108	143	309	309	18	-6.3	-40	477	
59	Abu Zigan	S	1	L. Cret.	34.8	6.1	1,054	76.9	140	546	1,318	4.5	1,309	1,223	18	-6.3	-40	4,465	

Table 1 continued

Location in Fig. 2	Location	Sample origin	Data source	Hosting formations	T (°C)	pH	Na (mg/L)	K (mg/L)	Mg (mg/L)	Ca (mg/L)	Cl (mg/L)	Br (mg/L)	SO ₄ (mg/L)	HCO ₃ (mg/L)	SiO ₂ (mg/L)	δ ¹⁸ O (‰)	δ ² H (‰)	TDS (mg/L)
60	Muallaha sp.	W	4	Quat.	23.3		4,600	362	332	2,408	10,877		3,479	397				22,058
61	Bassat el-Faras DEAD SEA AREA	W	4	Quat.	28.7		23	2.5	30	42	51	0.31	28	248				177
	<i>Western side</i>																	
62	Yam-7C	S	3	Quat.			1,230	155	782	410	4,840	98.6	103	320				7,619
62	Yam 7N	S	3	Quat.			954	117	579	342	3,620	72.2	93	325				5,778
62	Yam-1	S	3	Quat.			462	45.9	216	141	1,490	25.7	59	270				2,440
62	Yam-2	S	3	Quat.			414	41.4	193	139	1,310	22.5	57	290				2,177
62	Yam-5	S	3	Quat.			451	45.2	207	138	1,440	24.9	57	290				2,363
63	En Feshkha creek	S	1	Quat.	28.2		446	45.1	250	187	1,383	28.9	76	262	14	-5.3	-22	2,430
63	En Feshkha spring	S	1	Quat.	26.6		436	41.4	215	182	1,415	28.7	61	276	14	-5.4	-23	2,392
63	En Feshkha spring	S	3	Quat.			5,130	815	4,000	2,030	23,800	541	147	227				36,463
63	Feshkha	S	3	Quat.			8,560	1,350	6,900	3,550	40,200	886	225	298				61,671
64	Well Radon 1, 60 m	W	2	Quat.	26.00		12,870	1,839	9,480	4,954	57,092	1,200	700	168				
65	Kane A (spring)	S	1	Quat.	25.8		138	17.9	90	85	400	12	50	302	15	-5.6	-23	809
65	Kane B (north)	S	1	Quat.	26.9		178	21.4	114	112	597	11.6	66	300	15	-5.5	-24	1,115
65	Kane C (south)	S	1	Quat.	26.5		193	25.9	130	124	697	14.3	73	284	14	-5.5	-23	1,271
66	Mitspe Shalem-Mineral beach	W	1	Quat.	43.6		25,501	3,769	20,169	10,790	120,048	3,148	1,061	177	12	0.96	-3.4	184,498
66	Mitspe Shalem-Mineral beach	W	3	Quat.	43.6		26,200	4,020	21,000	11,500	123,000	2,690	1,110	100				189,520
67	Ein Gedi spring	S	1	U. Cret.	27.9	7.5	47	4.96	28	55	82	1.07	34	208	13			266
68	Dead Sea, 31°28.664'N; 35°24.980'E; depth: -60 m	L	1		25.8	6.2	33,800	8,050	46,012	20,720	222,677	5,700	343	220	5	4.24	22.3	335,331
69	En Gedi Spa	W	1	Quat.	39.4	6.5	23,990	2,380	11,705	9,136	88,161	1,673	466	163	16			137,527
69	En Gedi-3	W	3	Quat.			25,800	2,520	12,700	8,980	92,600	1,770	1,580	150				145,950
69	En Gedi-2	W	3	Quat.			54,500	4,780	21,800	15,000	176,000	3,100	400	230				275,580
70	Yeshu Springs	S	2	Quat.			27,824	0	18,685	10,290	117,663	2,209	1,060	142				177,731
71	En Kedem	S	3	Quat.			27,000	4,110	21,500	12,500	126,000	2,770	1,240	86				195,120
72	En Zeruya	S	3	Quat.			26,900	2,870	14,500	9,730	102,000	2,000	1,730	160				159,730
73	Massada 1	W	2	Jur.			2,990	316	1,081	1,840	9,017		2,640	61				17,884
73	Massada 1	W	2	Jur.			8,395	924.3	2,742	6,360	33,974		2,496	122				54,891
73	Massada 1	W	2	L. Cret.			1,357	106	106	844	1,916		2,436	317				6,659
74	Zohar Springs	S	2	Quat.			20,518	0	22,481	11,389	120,035	2,954	1,551	130				178,928
75	En Boqeq, Nirvana Htl. Gofrit well	W	1	Quat.	27.3	5.1	24,223	4,551	34,844	15,113	159,474	4,102	2,312	63	4	-2.1		244,622
76	En Boqeq, PB 26	W	1	Quat.	31.1	5.8	6,830	304	1,229	203	13,720	292	295	199	13			22,886
77	Hammei Zohar 15	W	1	Quat.	34	7.0	902	51	246	235	2,048	24.6	395	188	14			3,915
78	Lot-1	W	2	Tr.			9,890	799.5	9,185	42,840	119,209	2,468	816					185,207
78	Lot-1	W	2	Tr.			15,111	1,677	13,936	34,600	131,137	3,050	1,008	61				200,519
79	Sdom-1	W	2	Quat.			23,110	30,023	21,083	85,030	275,110	3,103						437,460
80	Sdom-2	W	2	Quat.			33,200	999	8,510	17,300	107,000	1,790	905	121				169,704
81	Sdom Deep-1 <i>Eastern side</i>	W	2	Tr.			32,904	4,778	5,456	77,345	216,444	4,305	42	150				341,274
82	Rama	W	1	Paleoz- L. Cret.	33.5	6.3	515	63.2	86	240	771	2.5	319	966	15	-5.3	-36	2,011

Table 1 continued

Location in Fig. 2	Location	Sample origin	Data source	Hosting formations	T (°C)	pH	Na (mg/L)	K (mg/L)	Mg (mg/L)	Ca (mg/L)	Cl (mg/L)	Br (mg/L)	SO ₄ (mg/L)	HCO ₃ (mg/L)	SiO ₂ (mg/L)	δ ¹⁸ O (‰)	δ ² H (‰)	TDS (mg/L)	
83	JICA well 5	W	4	Quat.	35.3	6.4	1,328	176	146	459	2,272	536	1,264	11	2.76	-5.7	-36	6,180	
84	Hisban artesian deep well	W	1	L. Cret.	32	6.4	347	46.2	77	197	560	1.8	251	767	13	-5.7	-36	1,491	
84	Hisban deep	W	4	Quat.	32	6.89	689	94.0	83	266	1,015	349	873	14	-5.7	-36	2,341		
85	JICA well 1	W	1	Paleoz.–L.Cret.	33.7	6.2	582	73.5	122	284	814	2.9	450	1,134	23	-4.1	-32	1,722	
86	Zarqa Ma'in Waterfall	S	1	Paleoz.–L.Cret.	57	6.2	452	49.1	34	177	727	3.2	258	371	20	-4.6	-37	1,115	
87	Zara Princess Basma Farm	S	1	Low. Cret.	51.7	6.2	268	31.4	21	122	494	2.4	155	212	13	-7.2	-42	341	
88	Ibn Hammat 2	S	1	Low. Cret.	38.8	7.2	79	6.1	18	53	106	0.5	65	206	61	2.76	-	322,558	
ARAVA/ARABA VALLEY																			
<i>Western side</i>																			
89	Arava 1	W	2	Quat.	50.510	1.030	1,030	14,100	50,600	202,500	3,674	144	61	61	202,000	3,670	122	319,922	
89	Arava 1	W	3	Quat.	50.500	1.030	1,030	12,000	50,600	202,000	3,670	122	61	61	202,000	3,670	122	319,922	
90	En Ofarim 5	W	1	L. Cret.	25	6.8	367	19.8	77	193	663	1.4	454	243	13	-7	-41	1,789	
91	En Yahav 6	W	1	L. Cret.	44.3	6.7	313	19.8	100	217	607	1.9	545	265	17	-7.2	-46	1,820	
92	Tzofar 20	W	1	U. Cret.	39.4	6.8	179	26.7	96	177	312	0.7	570	364	18	-6.8	-42	1,379	
93	Tzofar 20	W	1	L. Cret.	35.3	7.2	1,176	64.8	191	895	3,636	35.6	729	14	21	-8.1	-55	6,749	
94	Tzofar 4a	W	1	U. Cret.	26.5	7.1	196	8.7	80	212	421	0.9	448	204	17	-4.5	-23	1,383	
95	Paran 20	W	1	L. Cret.	59.2	6.7	323	28	95	286	748	3.8	609	207	25	-8	-53	2,117	
96	Paran 18	W	1	L. Cret.	36.3	6.7	200	29.3	81	208	408	0.9	627	307	22	-7.5	-50	1,575	
97	Yaalon 116	W	1	U. Cret.	32.6	6.7	255	12.1	151	335	746	1.5	653	322	15	-5.9	-35	2,169	
98	Yaalon 6A	W	1	L. Cret.	42.2	7.0	106	6.6	51	81	257	0.8	165	234	17	-5.9	-28	684	
99	Yaalon 7	W	1	L. Cret.	41.6	7.1	168	5.7	74	100	340	1	295	264	17	-5.9	-29	1,001	
100	Yaalon 117	W	1	Quat.	39.6	6.9	215	16.2	120	211	368	1.1	656	264	17	-6.9	-40	1,604	
101	Yotvata 13	W	1	U. Cret.	29.1	7.1	285	10	141	203	479	1.5	738	213	19	-6.5	-41	1,876	
102	Yotvata 12	W	1	U. Cret.	29	6.7	476	14.2	221	326	873	2.1	1,113	241	20	-6.4	-38	3,046	
103	Grofit 4	W	1	U. Cret.	33.3	6.9	312	15.8	110	272	765	3.9	574	220	14	-7.6	-47	2,067	
104	Samar 4	W	1	U. Cret.	31.8	7.2	337	10.9	106	175	631	3.3	678	131	19	-6.8	-39	1,960	
105	Samar 2	W	1	U. Cret.	28.3	6.8	681	45.9	248	619	1,346	9.4	1,832	195	15	-6.7	-46	4,796	
106	Eilat 103	W	1	Quat.	32	7.2	1,139	22.4	312	679	3,151	30.2	967	66	18	-7.2	-46	6,319	
107	Eilat 108	W	1	Quat.	31.8	7.2	431	12.8	160	233	967	7.7	636	140	20	-6.8	-42	2,467	
<i>Eastern side</i>																			
108	Wadi Araba 1	W	1	Jur.	29.9	7.2	79	2.2	32	129	202	2.4	125	235	12	-6.2	-33	584	
109	Wadi Araba 5	W	1	Jur.	27.3	8.4	783	9.6	111	676	2,723	43.6	66	8	7	-7	-35	4,419	
SOUTHERN JORDAN																			
110	Disi 1	W	1	Paleoz.	28.5	7.9	26	1.5	7.0	34	34	0.1	25	97	14	-6.5	-40	142	
111	Wadi Yutum	S	1	Quat.	29.7	7.7	114	2	20	79	194	1.5	93	109	21	-5.8	-31	525	

Q values, Cl-excess, and various ionic ratios are given