



# Characterization of Halide Compounds in Groundwater of Kuwait

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# Overview

- Kuwait is one of the countries that suffer from shortage in natural water resources.
- Limited natural freshwater resources.
- Small quantity of freshwater available in Raudhatain groundwater field in north of Kuwait.
- Annual rainfall approximately 110mm.



# Introduction

- Groundwater and seawater are two important water resources used in the production of drinking water in Kuwait.
- Groundwater is abstracted from two main aquifers; Kuwait Group and Dammam Formation.
- Protection of these water resources from pollution is one of the primary objectives of the Water Authorities in Kuwait.
- To monitor quality of natural water resources bodies, it is necessary to have a unique finger print of such water resources.



# Objective

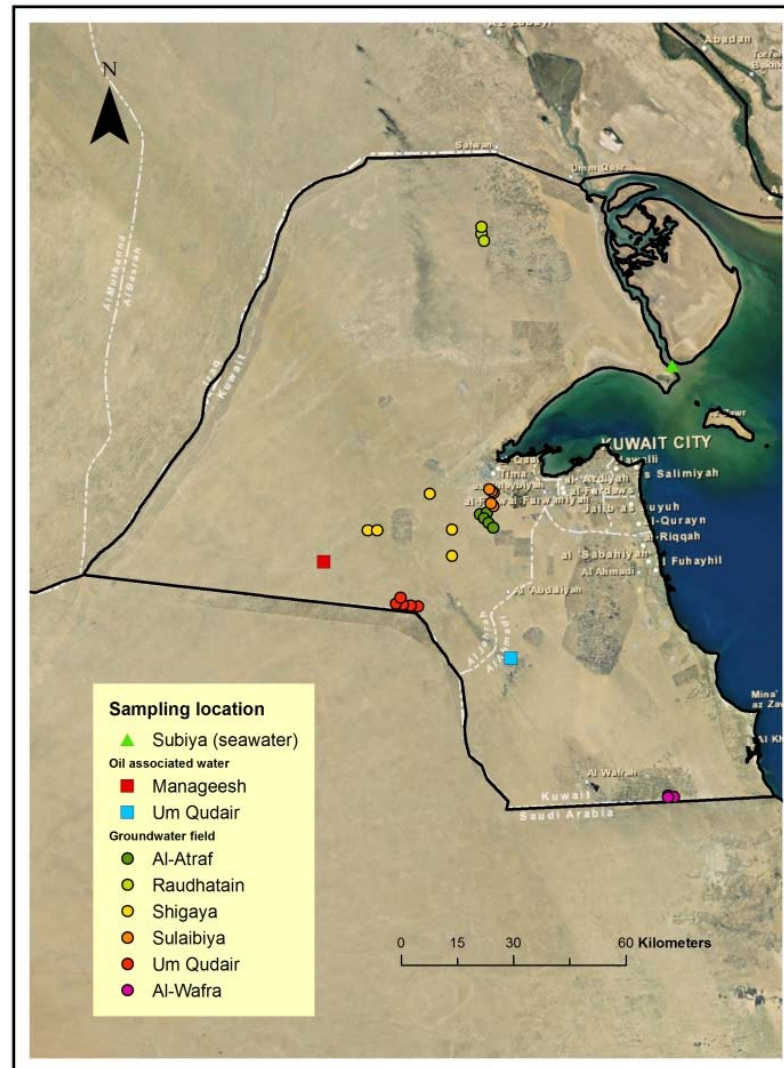
To identify the ratio of Br:Cl (finger print) of natural water resources in Kuwait.



# Methodology

- Natural water resources in Kuwait were sampled including groundwater production fields ( i.e. Al-Atraf, Raudhatain, Shigaya, Sulaibiya, Um Qudair and Al-Wafra), seawater and oil associated water.
- Groundwater wells at UG, AT and RA are screened through Kuwait Group, whereas, SU, SH and WW are screened through Dammam formation.
- Analysis of electrical conductivity, bromide and chloride were carried out in the laboratory.

## Cont., Methodology



sampling locations

## Cont., Methodology



Ion Chromatography Instrument Dionex ICS3000

# Results

The results of analyses of EC, bromide and chloride.

No	Well ID	Electrical conductivity ( $\mu\text{s}/\text{cm}$ )	Bromide (mg/l)	Chloride (mg/l)
1	UG59	5363	1.28	1141
2	UG60	5120	1.25	983
3	UG61	5123	1.30	995
4	UG62	5217	1.35	981
5	UG67	5507	1.37	1110
6	AT70	5774	2.04	1272
7	AT71	7884	2.51	1989
8	AT74	7021	2.34	1727
9	AT78	7484	2.37	1830
10	AT82	7080	2.28	1684
11	SU97	5194	1.68	687
12	SU98	5479	1.92	721
13	SU99	5593	1.78	731
14	SU119	4434	1.48	577
15	SU121	4986	1.55	634
16	RA3	2948	0.60	350
17	RA6	1377	0.24	281
18	RA15	1399	0.29	176
19	SH5A	3750	1.30	532
20	SH11D	3760	1.30	508
21	SH12A	3759	1.36	518
22	SH12D	3837	1.26	534
23	SH13A	4919	1.57	964
24	WW02	7480	9.59	1969
25	WW10	7350	9.58	1972
26	Seawater	61100	55.50	24440
27	Brinewater-A	106800	227.33	45000
28	Brinewater-B	275435	576.67	122911



# Results

No	Well ID	Br : Cl ratio
1	UG59	0.0011
2	UG60	0.0013
3	UG61	0.0013
4	UG62	0.0014
5	UG67	0.0012
6	AT70	0.0016
7	AT71	0.0013
8	AT74	0.0014
9	AT78	0.0013
10	AT82	0.0014
11	SU97	0.0024
12	SU98	0.0027
13	SU99	0.0024
14	SU119	0.0026
15	SU121	0.0024
16	RA3	0.0017
17	RA6	0.0008
18	RA15	0.0017
19	SH5A	0.0024
20	SH11D	0.0026
21	SH12A	0.0026
22	SH12D	0.0024
23	SH13A	0.0016
24	WW02	0.0049
25	WW10	0.0049
26	Seawater	0.0023
27	Brinewater-A	0.0051
28	Brinewater-B	0.0047

The Br:Cl ratio for the sampling locations



# Conclusion

- The groundwater of Kuwait Group aquifer in the tested wells has a ratio of Br/Cl between 0.0011 to 0.0017.
- The groundwater of Dammam aquifer in the tested wells has a ratio of Br/Cl between 0.0024 to 0.0027.
- The groundwater of Al-Wafra has a Br/Cl ratio equal to 0.0049. This might indicate interaction of the groundwater at the site with other water body.



# Recommendations

A thorough investigation should be carried out at Al-Wafra groundwater field to assess the quality of the water and to investigate any possible interaction between the groundwater with other source of water.

