

# Impact of trace elements on brines: Chotts and Sebkhass of the Algerian Low Sahara

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The brines in the Chotts and Sebkhass of Algerian Low Sahara are solutions characterized by a salinity that far exceeds that of the sea waters (120 to 440 g/l). Over the past three decades, these lacustrine systems become an estuary for all types of urban discharges, highlighting the environmental impact of these discharges on such systems.

The chemical analyzes show very high concentrations of certain trace elements, in particular Zn, Cu and Pb, with respective contents of 2.2, 1.6 and 0.03 mg/l. These trace elements are micropollutants that cause nuisance even when they are released in very small quantities.

**Keywords:** Brine, Chott, Sebkhass, Low Sahara, Trace Element, Impact.

## 1. Introduction

The trace element designation is commonly used to refer to naturally occurring chemical elements with a very low concentration (trace levels: less than 0.1%) in all compartments of the environment. The spatial distribution of these trace elements results from the combination of natural and anthropogenic factors. If the concentration at a given location is abnormally high, the environmental impact will be potential.

In Algerian Low Sahara, geochemical studies carried out on the brines of the Chotts and Sebkhass remain rare except studies on the geochemical evolution of brines (Hacini et al., 2008). In this context, we try to (i) determine the potential dispersion of certain trace elements, in particular Barium (Ba), Copper (Cu), Iron (Fe), Nickel (Ni), Lead (Pb), Strontium (Sr), Titanium (Ti) and Zinc (Zn); (ii) evaluate their environmental impacts based on comparison with reference values (standard).

## 2. Study site

The Algerian Low Sahara is a vast depression (-37 to 300m above sea level), partly occupied by the Grand Erg Oriental. This depression covers an area of 720,000 km<sup>2</sup> (Fig. 1).

## 3. Methods

Forty-eight samples were collected and analyzed in 2009 according to the protocol developed at the transfer geochemistry laboratory at CNRS Toulouse France (LMTG UMR 5055).

## 4. Results and discussion

### 4.1. Brines

The temperature measured in situ is generally around 20°C, and the electrical conductivity is above 150mS/cm. The slightly basic pH is recorded at Chott Ain El-Beida and Sebkhass Safioune; while the slightly acidic pH is recorded at Chott Baghdad and Chott Merouane. The average concentrations of the trace elements are generally higher than the reference values (Table 1).

These results make it possible to say that the trace element contents depend on the acidity of the pH and the abundance of organic matter. The acid pH values recorded at Baghdad and Merouane Chotts correspond to high levels of trace elements. On the other hand, the basic pH recorded at Chott Ain El-Beida and Sebkhass Safioune corresponds to lower levels of trace elements. Both Chotts are strongly polluted by urban discharges, whereas the others which are out of contact with these discharges.

### 4.2. Solid salts

The results of the analysis show that the contents of solid salts in trace elements are generally lower than the reference values (Table 2). It seems clear that trace element concentrations are very high in brines than in solid salts; which reflects the important effect of water for pollutants in general and trace elements in particular.

## 5. Conclusion

This study has shown that Chotts and Sebkhass in the Algerian Low Sahara have deterioration indices shown by high levels of trace elements. It appears that the main anthropogenic source of metals is that produced by sewage effluents. It is identified as one of the first anthropic-induced environmental impacts, and the need to reduce these releases is no longer discussed.

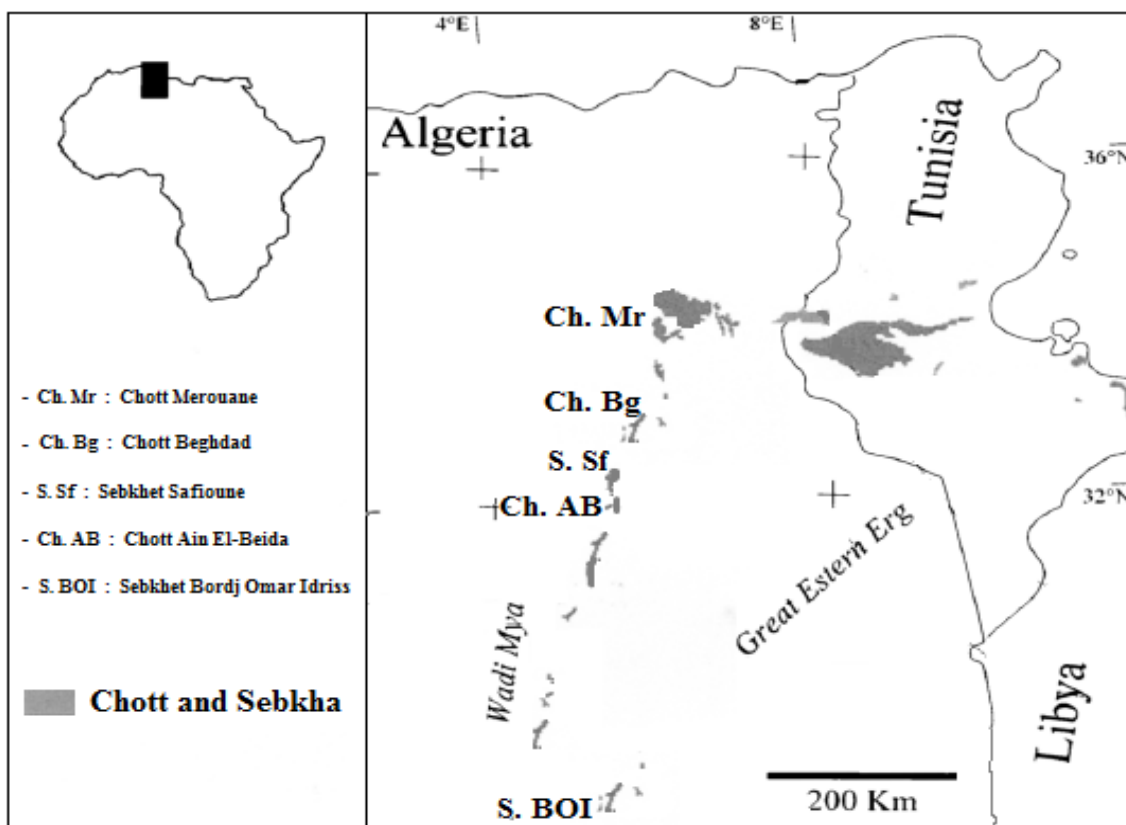


Figure 1. Location of the study site

Table 1. Trace elements in lakes of Algerian Low Sahara (brines)

Station	T (°C)	pH	Cond (mS/cm)	Ti (µg/l)	Fe	Ni	Cu	Zn	Sr	Ba	Pb
Sebkhet Bordj Omar Idriss	/	/	/	632	50	52	1006	1951	20103	25	22
Chott Ain El-Beida	27	8.21	151	388	73	21	1551	2315	17065	33	26
Sebkhet Safioune	20.3	7.25	170	83	/	12	/	1933	10692	13	18
Chott Baghdad	20.7	7.4	175	82	74	110	1962	2304	22507	107	39
Chott Merouane	17	7.9	179	128	577	30	1801	2390	21239	16	26
Standard*	25	7.0 to 8.7	/	/	1300	20	3.7	86	21000	/	7.2

\* T (°C) (IBGE, 1987) ; pH (CCME, 2002) ; Fe (SAVEX, 2000) ; Ni, Pb (INERIS, 2006) ; Cu, Zn (U.S. EPA (1997) ; Sr (MDEQ (2008)

Table 2. Trace elements in lakes of Algerian Low Sahara (extracts)

Station	Ti (µg/l)	Fe	Ni	Cu	Zn	Sr	Ba	Pb
Sebkhet Bordj Omar Idriss	663	78	12	416	145	31770	15	1
Chott Ain El-Beida	412	55	14	1038	152	13666	58	7
Sebkhet Safioune	4	43	12	1108	115	2340	87	6
Chott Baghdad	6	24	16	2228	121	4443	99	53
Chott Merouane	11	30	13	1845	144	1152	60	5
Standard (in ppm)*	5600	56300	84	60	70	370	425	14

\* Haynes (2016)

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