

CARACTEREZATION OF THERMAL SRPING WATERS DJEBEL SAFIA – NORTH EASTERN ALGERIA -

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ABSTRACT

Today, as in the past thermal stand are stretched by the Algerian for various treatments of rheumatic, dermatological and psychiatric.

In Algeria there are more than 200 thermal springs of high energy (> 150 ° C), medium or low temperatures (between 30 ° C and 150 ° C), a significant number is located in northern Algeria, and are intended for various uses. The main purpose of this paper is to characterize the thermal spring waters of Jebel Safia (North East Algeria).

Three sources (temperature > 40 ° C) and a drill were inventoried in the region, characterized by fractured formations.

The fieldwork began in March 2009 and completed in August 2009. They were preceded by reconnaissance visits to the field to locate the sources that make the object of study.

Mineralization of water is determined primarily by the chemical and mineralogical nature of the sediments they traverse. The results of chemical analysis performed showed different hydro chemical facies due to clay and limestone formations constituting Jebel Safia.

KEYWORDS: thermal stand - characterization of water - sources - chemical nature.

1 INTRODUCTION

This chemical study is based on a comprehensive analysis of samples at the three sources and drilling that are very near and around the region of Jebel Safia. To achieve this aim, three rounds of sampling and analyzes were conducted, the first reported in March 2008, the second in May 2008 and the last in August 2009.

2 MATERIAL AND METHODS

The physico-chemical parameters (pH, temperature (° C), conductivity and rate of salinity (TDS) were measured in situ using field devices with selective probes (pH meter Mettler Toledo MP 120, conductivity brand HANNA instruments Hi 8633).

3 STUDY AREA

Our study area is located in the north-eastern of Algeria between the wilaya of Annaba and Skikda, it belongs to the coastal watersheds Constantine center (5582 km² in area).

These limestones Jebel Safia which are essential to the operation of the cement Hadjar Soud. It includes:

- The south side of the mountain range Filfila representing the East extension of the massive Kabylia.
- The limestone mountains of Jebel Safia and Messaoud If located within 59 km of Annaba, 7 km from the cement Hadjar Soud and 114 km from Constantine.

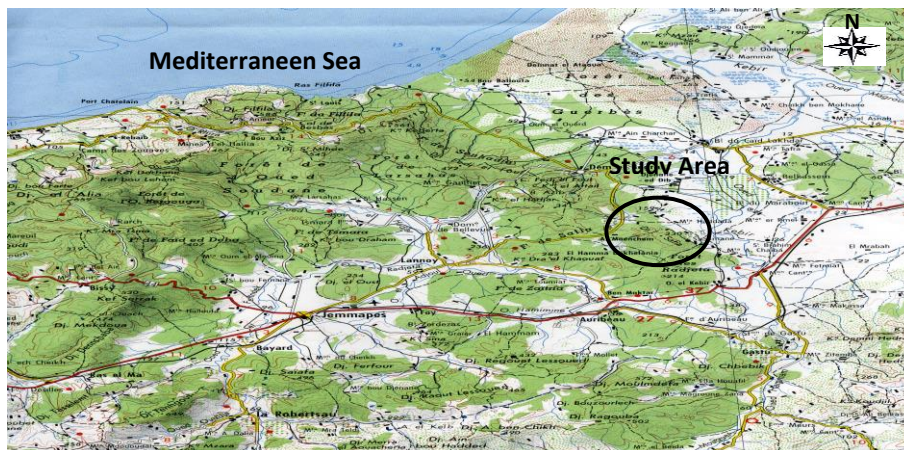


Figure 1. Location of the study area.

4 RESULTS AND DISCUSSION:

To see the evolution of the most dominant elements in the water sources of Jebel Safia, their concentrations and sources, we took into account the concentrations of elements.

4.1. Evolution of calcium (Ca⁺⁺)

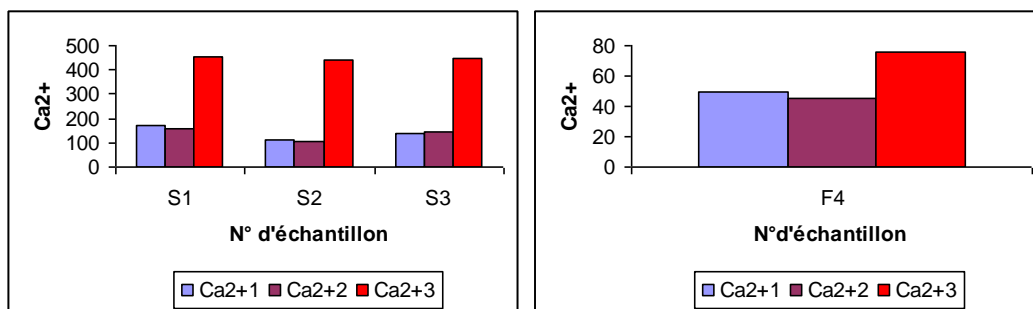


Figure 2. Evolution of calcium sources and F4 drilling (March 2009, May 2009 and August 2009).

Figure 2 shows low calcium concentrations in the waters of thermomineral sources of Jebel Safia between 108.1 mg.l-1 (S2.2) and 170 mg.l-1 (S1.1) for the periods months of March and May 2009. While high concentrations which are peaks between 439.3 mg.l-1 (S2.3) and 456.9 mg.l-1 (S1.3), characterize the period of August, 2009 (low water).

Low concentrations were noted in the waters of drilling F4 does not exceed the amount 75.27 mg.l-1.

4.2. Evolution of magnesium (Mg⁺⁺)

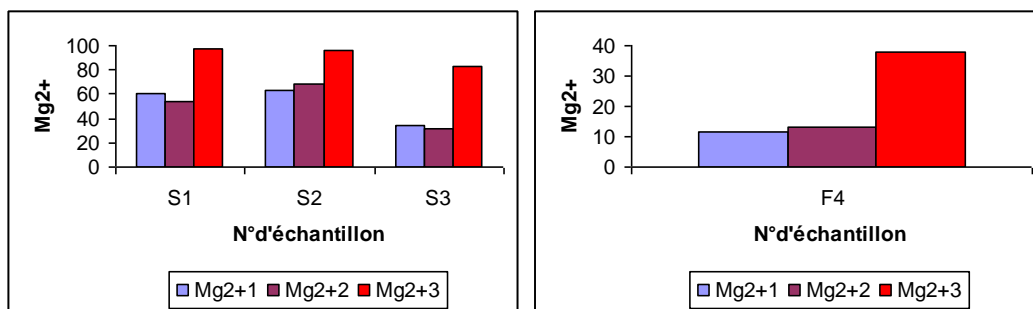


Figure 3. Evolution of magnesium sources and F4 drilling (March 2009, May 2009 and August 2009).

From Figure 3, the highest concentrations of magnesium in water sources Jebel Safia reached 97.2 mg.l-1, 95.7 mg.l-1 and 82.6 mg.l-1 respectively in S.1, S .2 and S.3 during the month of August

2009 (low water). On the other side, magnesium concentrations that characterize periods in March and May 2009 are low contribution to the period of August 2009 and does not exceed the level of 68.81 mg.l-1.

Water drilling F4 also has very low concentrations ranging between 11.7 and 37.7 mg.l-1.

4.3. Evolution of sodium (Na^+)

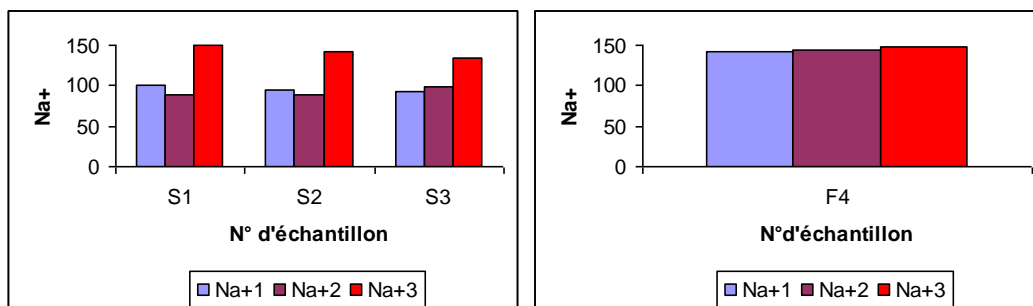


Figure 4. Evolution of sodium sources and F4 drilling (March 2009, May 2009 and August 2009).

Sodium often comes:

- From the weathering of silicate minerals, cation exchange with clay minerals or organic substances.
- Discharges of sewage, as well as the spreading of chemical fertilizers that increase the concentrations of sodium.

The majority of sources are usually high in sodium and reach their maximum in August 2009 at the level of the source S1 with 150.3 mg.l-1. contrariwise in the period of high water levels in sodium is between 89.6 and 100.6 mg.l-1. In drilling (F4), sodium levels are 148.3mg.l-1 (August 2009), 145mg.l-1 (May 2009) and 142mg.l-1 (March 2009).

4.4. Evolution of potassium (K^+)

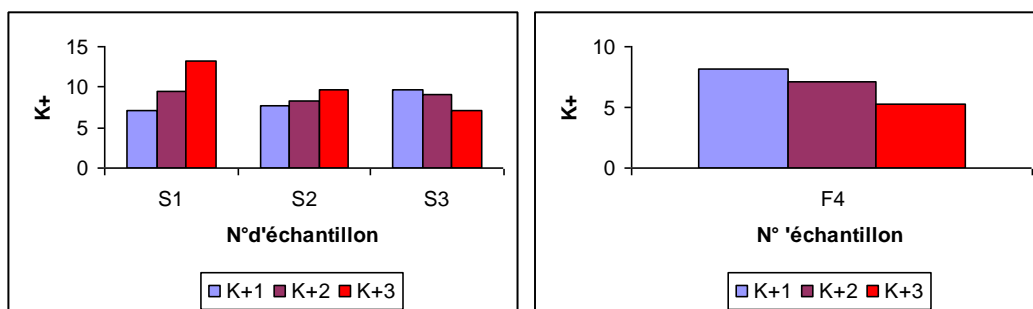


Figure 5. Evolution of potassium sources and F4 drilling (March 2009, May 2009 and August 2009).

Potassium concentrations during high water generally vary between 7.2 and 9.45 mg.l-1. In times of low water levels are slightly elevated and reach their maximum 13.2 mg.l-1 to the source S1. The contents of this element with drilling F.4 are 8.2 mg.l-1 in March 2009, from 7.04 mg.l-1 in May 2009 and 5.2 mg.l-1 in August 2009.

4.5. Evolution of carbonates (HCO_3^-)

From Figure 6, the concentration of bicarbonate increases in periods of low water for all sources and reach their maximum of 340.4 mg.l-1 at the source S1. By cons during high water levels vary between 310 and 329.24 mg.l-1. The highest carbonate drilling (F4) concentration of 412.3mg.l-1 (August 2009).

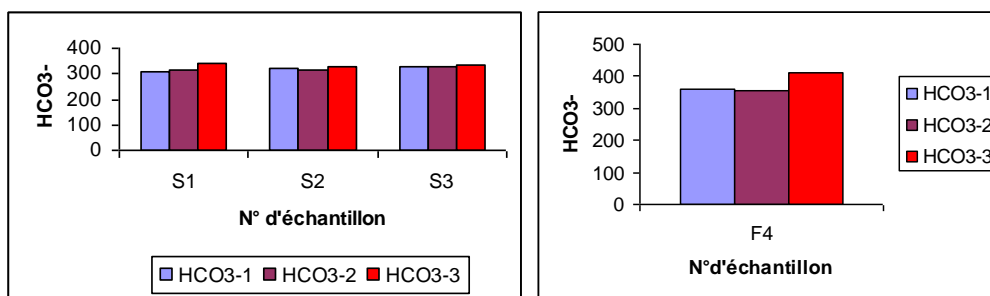


Figure 6. Evolution of carbonates sources and F4 drilling (March 2009, May 2009 and August 2009).

4.6. Evolution of chlorides (Cl⁻)

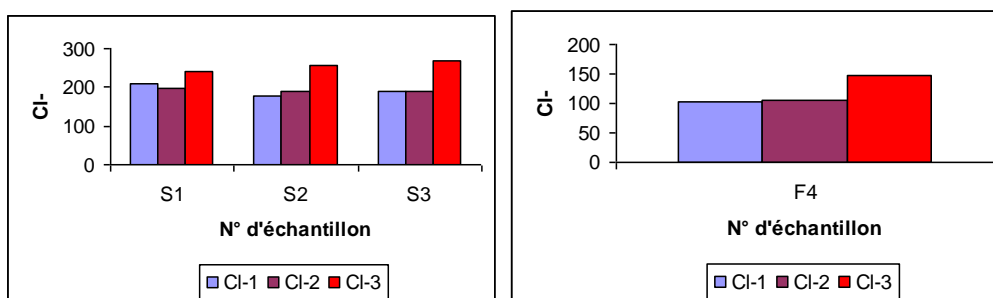


Figure 7. Evolution of chlorides sources and F4 drilling (March 2009, May 2009 and August 2009).

The chloride concentrations observed during low water in the water sources S1, S2, S3 are respectively 241.8 mg.l⁻¹, 256.4 mg.l⁻¹ and 268.9 mg.l⁻¹. While during periods of high water levels vary between 179.5 and 210.7 mg.l⁻¹. The values of chlorides drilling (F4) during periods in March, May and August 2009 are: 102 mg.l⁻¹, 106.5 mg.l⁻¹ and 148.35 mg.l⁻¹. The origin of chloride is mainly due to the dissolution of the salt formations.

4.7. Evolution of sulphate (SO₄²⁻)

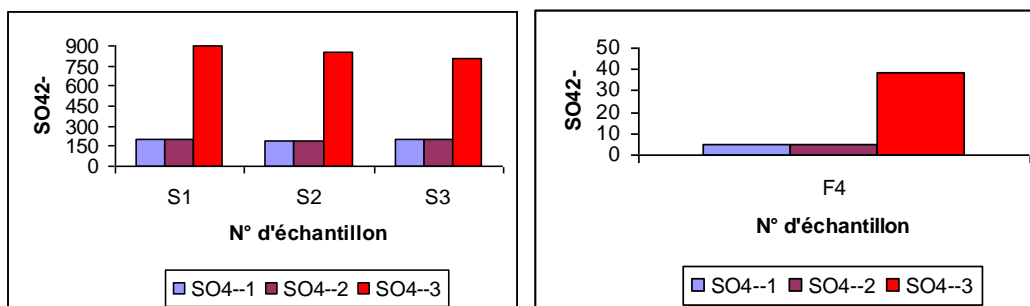


Figure 8. Evolution of sulphate sources and F4 drilling (March 2009, May 2009 and August 2009).

The highest concentration of 902.4 mg.l⁻¹ in the source S1 during the month of August 2009, 204.3 mg.l⁻¹ in May and 196.3 mg.l⁻¹ in March. Drilling (F4) concentrations of this element are very small contribution to sources, 5.3 mg.l⁻¹ in March 2009, 4.62 mg.l⁻¹ in May 2009 and 38.4 mg.l⁻¹ in August 2009. The presence of sulfates is due to the presence of gypsum in its training.

5 Conclusion.

According to the chemical facies identified in the region of Hajar Soud namely chlorinated lime, chloride-magnesium, calcium bicarbonate and calcium sulfate, it is likely that the origin of these elements is mainly due to the lithology field knowing that it is composed of Numidian clay, sandstone and limestone formations.

The water thermomineral sources of Jebel Safia calcium concentrations during the months of March and May 2009 are generally low. An Obviously concentration in the F4 drilling does not exceed the value of 75.27 mg.l⁻¹.

Water sources contain magnesium concentrations are low and do not exceed the level of 68.81 mg.l⁻¹. Water drilling F4 also has very low concentrations of magnesium and vary between 11.7 and 37.7 mg.l⁻¹.

The majority of sources are usually high in sodium and reach their maximum in August 2009 at the level of the source S1 with 150.3 mg.l⁻¹.

Potassium concentrations during high water generally vary between 7.2 and 9.45 mg.l⁻¹. By against during low water levels are high and reach their maximum of 13.2 mg.l⁻¹ at the source S.1.

Bicarbonate concentrations increase in low water period for all sources is reaching their maximum of 340.4 mg.l⁻¹ at the source S.1.

Sulfates are present in high concentrations in the three water sources. The highest concentrations were 902.4 mg / l at the source S.1 during the month of August 2009, 204.3 mg / l (S.1) in May and 196.3 mg / l (S1) in the month of March. In the F4 drilling sulphate concentrations are very low next to the sources, 5.3mg / l in March 2009, 4.62 mg / l in May 2009 and 38.4 mg / l in August 2009. The presence of sulfates is due to the presence of gypsum in its training. These facies tend to prove purely lithological origins due to clay and limestone formations constituting the Djebel Safia.

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