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Quality of water and their ability to irrigate the area of El-Ghrous in the wilaya of Biskra (Algeria).

N. Bougherira [1], A. Rezek[1], A. Drouiche [1], W. Hamzaoui [1], N. Chaib [1], L. Djabar [2]
[1] *Centre for Scientific and Technical Research on Arid Regions - CRSTRA - Biskra, Water & Soil Division, algeria*
[2] *Department of Geology, University Badji-Mokhtar-Annaba-CRSTRA Research Associate, Algeria.*

Abstract
The region of El-Ghrous, has known an important agricultural rise which required the extensive use of inputs, where the risk to cause pollution of ground water in the region (Mio-Pliocene and Lower Eocene).
These two layers are collected from boreholes of which there are 40 holes at the lower of the Eocene and 13 at the Mio-Pliocene.

Chemical analysis conducted in the laboratory of CRSTRA (November 2010), showed that the water was particularly rich in SO_4^{2-}, Ca^{2+}, Na^+, K^+, Mg^{2+} and HCO_3^-. In detail, we note that the sulfates are high concentrations reaching values ranging from 1.43 $g.l^{-1}$ to 3.14 $g.l^{-1}$ in the water of the

Mio-Pliocene and 0.16 $g.l^{-1}$ to 2.24 $g.l^{-1}$ in the water from the lower Eocene, which gives the water a calcium sulfate facies sometimes to sodium sulfate. The measured conductivity is still high for the waters of the Mio-Pliocene with 5.62 mS/cm; however we notice relatively drop for the waters of the lower Eocene (2.55mS/cm).

These concentrations determined, led to the calculation of the SAR. The latter combined with the conductivity to determine the suitability of ground water for irrigation.

*Keywords**:** El-Ghrous - Mio-Pliocene - Lower Eocene - chemicals major- index SAR - irrigation suitability.*

1. Introduction
Irrigated areas of the municipality of El-Ghrous one of the largest and oldest (since 1980) developed areas in large plots. Repeated drought (monthly average max 22.38 mm at the station Biskra, and 13.4 at the station Daoucen) and limited water resources have not allowed the recovery of huge efforts in terms of hydro - agriculture planning which permit the development of the exploitation of groundwater.

This work is part of the research project "Impact of the New Agriculture on the Quality of Groundwater and Soil: Case of the Region of El Ghrous (wilaya of Biskra)," for the establishment of a knowledge base on the management of water demand in the region of El-Ghrous. This study focuses on the identification and assessment of the exploitation of groundwater (Mio-Pliocene and Lower Eocene) for agricultural purposes by means of quantitative and qualitative indicators. Reporting features have helped to define the main features characterizing of salinity (content, origin and evolution) and reveals the dominant hydrochemical facies. The waters of the shallow aquifer in the study area have shown a moderate to relatively high salinity. The latter has even revealed a bad drinking water.

2. Study site
Located almost 50 km west of the capital of the Wilaya of Biskra (called Zab Gharbi), the study area extend entirely in the territory of the municipality of El-Ghrous where cadastral survey represents 47% of the total

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municipal area is 11,628 Ha. It is bounded on the north by the town of Tolga, West by the municipality of Ech-Chaib, on the East by the municipalities of Bordj Ben Azzouz and Foughala and South by the municipalities of Doucen and Lioua (figure 1).

Figure 1: Study Area CRSTRA 2011-

3. Hydrogeological aspects

The wilaya of Biskra has significant groundwater resources, represented in addition to the Quaternary aquifer systems; with two other aquifer systems, which are the Terminal Complex and Continental midsole.
Water resources of the wilaya of Biskra in its West part: is characterized (in addition to the Quaternary aquifers, upper Senonian, and Albo-Barremian by the following ground water [4] :

- Mio-Pliocene: this aquifer is operated south of the region of Tolga at a depth of up to 150 m; it is characterized by a flow of 15 l/s and medium chemical quality of water.
- Lower Eocene : this aquifer is the most requested area of Zibans, its depth varies from 90 to 500 m south of Tolga, and it is characterized by an average flow of 20 l/s and average water quality.

4. Materials and Methods:

The physico-chemical measurements were performed in the laboratory of CRSTRA,

A dominant facies: calcium sulfate, the two dominant facies are: calcium sulfate, and sodium sulfate for water for irrigation from the lower Eocene.

- The elements measured on site are: Temperature, pH, Eh, salinity, conductivity, dissolved oxygen. These measurements are made using a multi-parameter type WTW 350i, a brand GPS GeoExplorer 3 system Trimbelle.
- To perform the analysis we used: NF T90-003 (August 1984) - NF T90-016 (August 1984) **[5]**.
- Note that the collection, transportation and storage of samples that is to say, transported in a cooler at 4 ° C.

Our investigations at the agricultural farm in the study area allowed us to identify 40 drilling Lower Eocene and 13 Mio-Pliocene currently operational. Work is carried out on 03 companions (figure.2).

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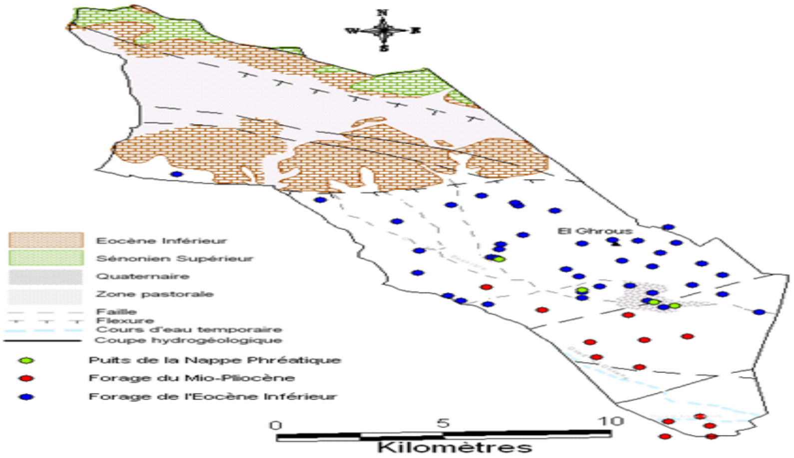

Figure 2: Inventory of Drilling of Mio-Pliocene and Lower Eocene (El-ghrous. W of Biskra).

5. Sodium absorption ratio (SAR or R $_{Na}$)

Report applied to the sodium ions in soil solution and irrigation water to express the relative activity of exchange reactions with soil [3]:

$$SAR = \frac{Na}{\sqrt{\frac{Ca + Mg}{2}}}$$

Where : Na, Ca and Mg are expressed in mill equivalents per liter. FAO 1985 described a revised method of calculating the adjusted SAR (R $_{Na}$ corrected).

The value of the electrical conductivity of groundwater is the highest recorded level of the water of the Mio-Pliocene (5620µS/cm). And lower values (1711 S / cm) are related to the Lower Eocene. However, the two layers remain in the category of very high salinity. For the SAR, the drilling of groundwater and Mio-Pliocene shows the highest values exceeding the value of 6. This is not the case for the waters of the Lower Eocene, and some drilling of the Mio-Pliocene when the average value of SAR is less than 3.

6. Reporting features

During their stay underground, waters dissolve a number of substances including limestone is $CaCO_3$, dolomites and dolomitic limestone (Ca, Mg) CO_3, gypsum $CaSO_4$, $2H_2O$, anhydrite $CaSO_4$, NaCl sodium chloride, potassium chloride KCl. The dissolution of these substances, constituting the main mass of soluble sedimentary rocks, is necessarily relatively large

The (figure 3) shows the evolution of calcium in relation to sulfate. Points represent an evolution of both sides of these two elements indicating an excess, probably due to a common origin saline due to the dissolution of gypsum which explains the dominance of the calcium sulfate facies.

The dispersion of points in the graph of (Figure 4) shows the evolution of calcium according to the bicarbonates. These two chemical elements have different origins.

The report points on the figure showing the relationship between Ca^{2+}, HCO_3^- in Figure 4, Cl^- and Na^+ in (Figure 5), shows that 50% of the points undergo a base exchange explained by the excess Na^+ accompanied by a deficiency of Ca^{2+} [2].

Examination of (Figures 6&7) shows a predominance of sulfates in succession on the calcium and sodium, and we note that the majority of points are located below the right. Thus we notice that changes in the calcium sulfate is concomitant, this relationship reflects the dissolution of the original saline sulfate (gypsum) [1]. An examination of (Figure 8) shows that the Na^+ and Cl^- move in the same direction. Figure 9 shows that except for some points showing an excess of Cl^-, progress in concentrations is proportional to sulphates

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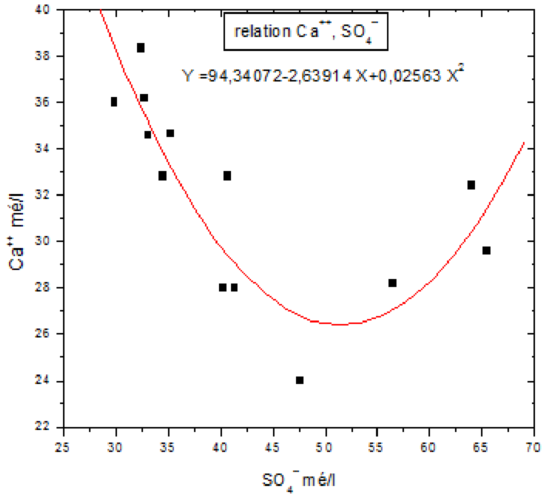

Figure 3: Relation Ca $^{2+;}$ SO_4^-

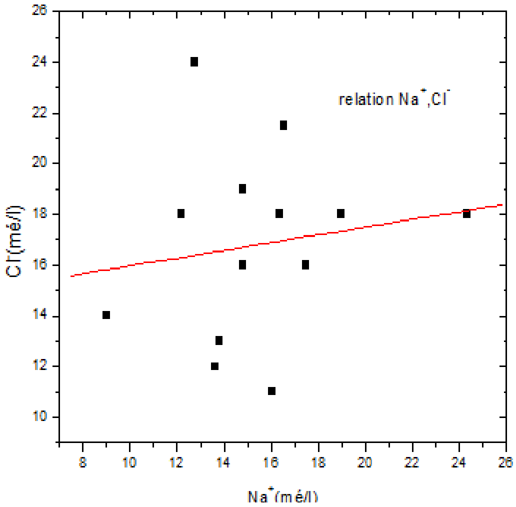

Figure 4: Relation Ca $^{2+;}$ HCO_3^-.

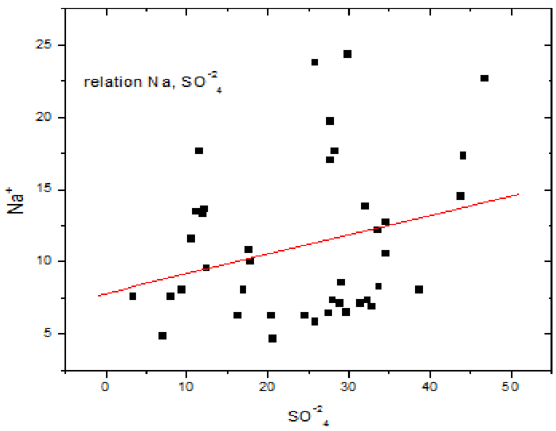

Figure 5: Relation Na +; SO4-

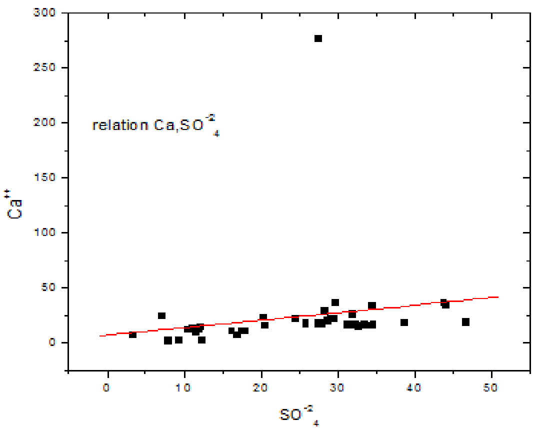

Figure 6 : Relation Ca 2+; SO4

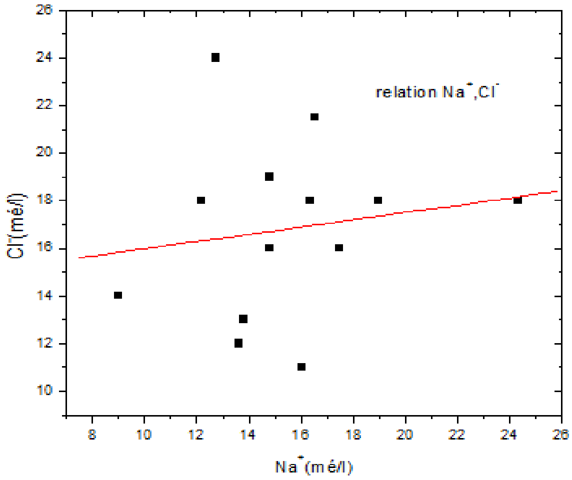

Figure 7: Relation Cl$^-$, Na $^+$.

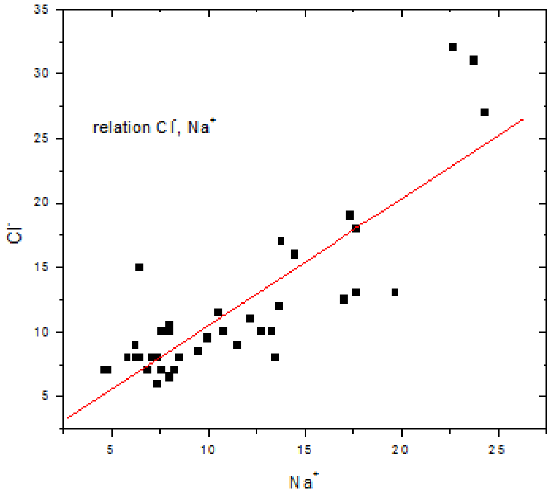

Figure 8: Relation Cl$^-$, Na $^+$.

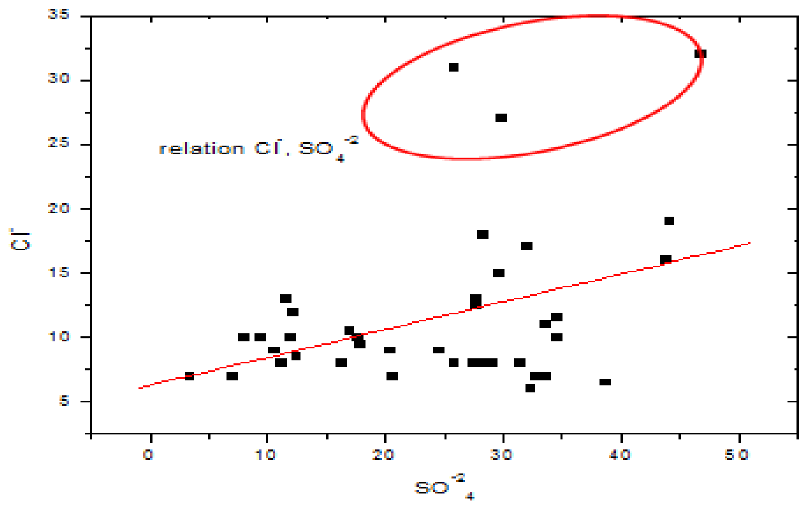

Figure 9 : Relation Cl^-, SO_4^-.

Conclusion

The water coming through the drywall very quickly to have high levels of $CaSO_4$, often ranging up to saturation. Similarly, water crossing salt-bearing lands contains a large amount of chlorides.

It should be noted that the increase in SO_4 results not only an increase in calcium but also magnesium, gypsum always contain a greater or lesser proportion of Mg. Moreover, once the saturation SO_4Ca reached, it cannot grow. Only SO_4Mg can still dissolve.

The water then come to have extremely high levels of SO4 and Cl, Ca, Mg and Na, giving them dry residues that may reach more than 200 g /l.

Although the two layers used for irrigation are characterized by relatively high salinity (4.26 $g.l^{-1}$ and 1.91 $g.l^{-1}$), the crops grown

(Tomatoes, eggplant, peppers) would accommodate at least at present quite well if 'judging in comparison of average yields (100 Kanto / greenhouse).

Nevertheless, periodic monitoring of changes in the salinity of the drilling is to advocate and that due to agricultural development and exploitation of water resources that results.

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