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**Research Article**

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## Assessment of metal pollution in the waters of the Oulja wells, Oum Er-Rbia watershed

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**Abstract** The spatial and temporal variations of some heavy metals in the waters of oulja wells have been studied. The results obtained showed that the iron content in all the wells is below the limit value of the water used to produce drinking water (Moroccan standard). For the chrom, its concentration varies from one well to the other, so the lead presents significant spatial variations. Moreover, the values found for zinc show no anomaly for the quality of the water and in the end the waters loaded by the manganese are classified according to the Moroccan water quality grid in a good class.

**Keywords** metal pollution, water, Oulja wells, Oum Er-Rbia watershed

### 1. Introduction

Groundwater is an important natural resource. They represent a reservoir from which, if properly protected, good quality water can be drawn for the supply of drinking water as well as for agriculture and industry. They are also valuable for maintaining wetlands and river flows, as well as providing buffer resources during periods of drought. Groundwater indeed maintains many ecosystems that provide a wide range of services to the population. Groundwater interacts with other types of water bodies: on the one hand continental freshwater (rivers, wetlands, lakes ...) and on the other hand the marine waters along the coast. The meaning of these transfers may vary during the year depending on the hydrological conditions. They often provide the basic flow of surface continental water systems and therefore influence their quality. Through their subterranean circulation, the phreatic waters are charged with a certain number of soluble chemical elements, in contact with the different terrains traversed: chlorides, carbonates, sulphates and others. These elements may be of geological or anthropogenic origin. In other words, potential sources of groundwater pollution have multiplied in recent years [1]. Among the most widespread contaminants nitrates are important because they are produced by basic human activities (agriculture, domestic activities, industries, etc.). A high concentration of nitrate in drinking water can be pathological for humans and animals [2].

Thus the study of the contamination of groundwater has attracted the attention of several researchers in Morocco. Indeed, H. TAOUIL and colaborators were worked on the evaluation of the metallic pollution of the wells of Tyikomiyn, Talssint region, eastern Morocco [3-5]. The percolation of water through the waste causes the production of leachate which is loaded with organic matter, bacteria, mineral compounds and heavy metals. The leachate, which is the main transport vehicle for metallic pollution from waste disposal sites [6], has a very random composition and varies according to the nature of the waste. In the study area, the geological, geographical and hydro-climatological analysis makes it possible to evaluate the importance of the permeability of the formations forming the plateau of the coastal Chaouia aquifer. This favors the infiltration of rainwater into the area characterized by an annual rainfall of around 424 mm (Azemmour station) thus constituting a parameter in favor of the production of large quantities of leachate and subsequently the contamination of groundwater. piezometric studies have also shown that the shallow depths of the aquifer, generally less than 10 m with a minimum of 1.5 m, are observed in the coastal areas and in the eastern part where the aquifer circulates in the aquifer "Primary altered-Pli-quaternary "under permeable soils. These are agricultural areas, considered a priori as potential sources of groundwater pollution [7-10]. In addition to these pollutants, the influence of domestic sewage can be directly discharged into the environment without prior treatment due to the absence or malfunctioning of sewage treatment plants. The quality of water is one of the permanent concerns of the man who has devoted all his legislation to it and has ratified numerous international protocols and conventions for its protection and preservation. In order to put ourselves in this context, the objective of our study is to evaluate the metallic contamination of the well water of the Oulja coastal zone, of which a not insignificant number of its population rely on groundwater

## 2. Evaluation of the metallic pollution of the aquifer of oulja

Our choice was made on the metals commonly encountered in well water namely: Lead, Chromium, Manganese, Cobalt, Iron, Copper, Cadmium and Zinc.

### 2.1. Iron (Fe)

In our study and according to fig.1, the results obtained show that the average iron contents are low and remain below the imperative value of the water favorable for irrigation 5mg / l (Moroccan standards). A higher level at 53.5 µg / l was observed at Well 3 level. This increase could be explained by agricultural and domestic contamination. It should be noted that this well exists in the vicinity of a rural agglomeration and an agricultural zone from which wastewater discharges infiltrate the groundwater. However, the iron content of all wells is below the limit value of the water used to produce drinking water 300 µg / l (Moroccan standard). In addition, the waters of wells P3, P4 and P5 have values exceeding normal freshwater values <30 µg / l (184).

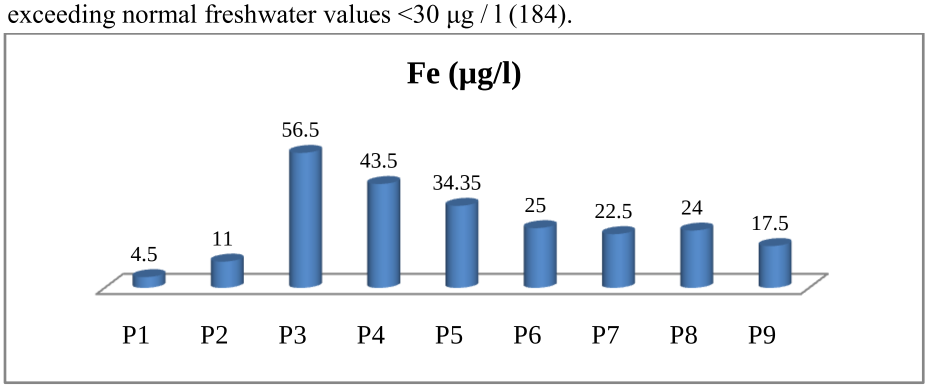


*Figure 1: Spatial variation of the mean iron content of the oulja wells*

### 2.2. Cadmium(Cd)

According to the results of the analysis illustrated in fig.2, it is observed that the average Cd content is below the limit value of the water intended for irrigation 10 µg / l (Moroccan standard). However, the average values found in all wells, except wells 1 and 2, are lower than the mandatory value of the water intended for the production of drinking water (5 µg / l). Moreover, the concentrations found at wells 1 and 2 are likely to disturb the equilibrium of the study medium.

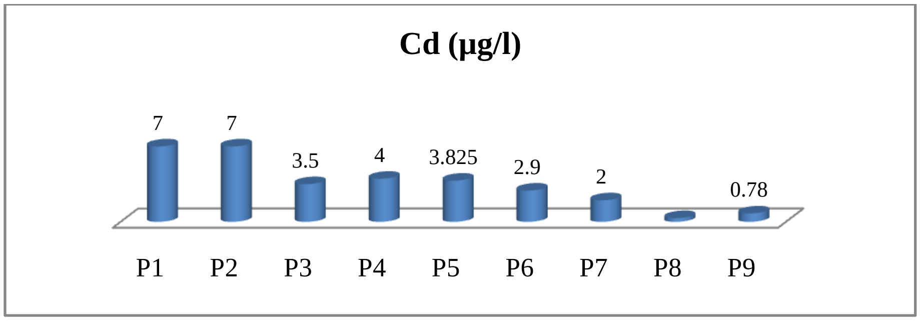


*Figure 2: Spatial variation of the average Cd content of wells*

### 2.3. Chrome (Cr)

Les teneurs moyennes en chrome sont assez variables d'un puits à l'autre .La valeur la plus élevée est enregistrée dans les eaux du puits 1 situé dans les environs immédiats d'une école primaire. Ainsi la source de pollution pour cet élément au niveau de ce puits pourrait être anthropique et naturelle. Néanmoins, dans le reste des stations les teneurs moyennes en chrome restent inférieures à la valeur impérative des eaux destinées à la production de l'eau potable (50ug/l).

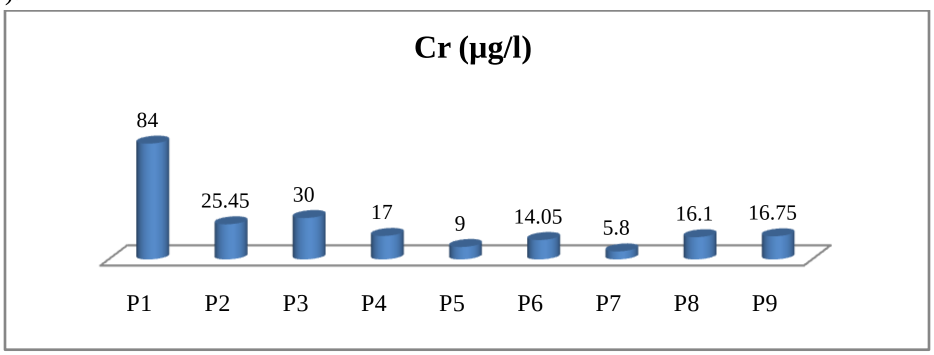


*Figure 3: Spatial variation of the mean Cr content of wells oulja*

### 2.4. Copper (Cu)

The mean values recorded in all sampled samples fluctuate from 0 µg / l, which is a marked minimum value at wells 8 and 9 and 335 µg / l detected as the maximum value detected in Well 7 waters. However, this maximum value is slightly higher than the limit value of water intended for irrigation, which is 200 µg / l recommended by Moroccan standards. Moreover, and according to the same standards, it is lower than the imperative value of the water intended for the production of drinking water (1mg / l). Thus the source of pollution in this element at this well could be attributed to the nature of the composition of the rock substrates and the contamination due to sewage infiltration. It should be remembered that the latter come from the use of well water 7 as a rite linked to witchcraft. The average contents of the other wells remain below the value of potability and irrigation according to Moroccan standards. Therefore the waters of these wells are attributed to the good class <50ug / l.

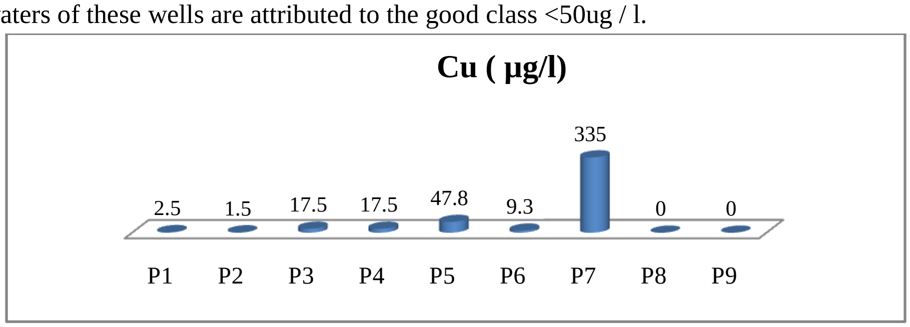

*Figure 4: Spatial variation in average Cu content of wells*

**2.5. Lead (Pb)**

In our study, according to Fig5, lead has quite significant spatial variations. The average Pb content ranges between two extreme values: 0.5ug / l recorded in Well 9 waters and 35.5ug / l displayed at Well 3 water level. However, the wells surveyed are favorable for irrigation. Their Pb content does not exceed the limit value of 50 µg / l set by the Moroccan standard, but they considerably exceed the average contents of the uncontaminated soft natural waters 0.2 g /l [11]. Note that the waters of well 3 are rich in this element. The source of their Pb enrichment could be due to the high amount used in fertilizing, as this well is located in a well developed cultivated field. Thus, studies on fertilizers in Canada have shown that these products contain up to 3.5 mg / kg of Pb (nitrogen-phosphate fertilizer). [12].

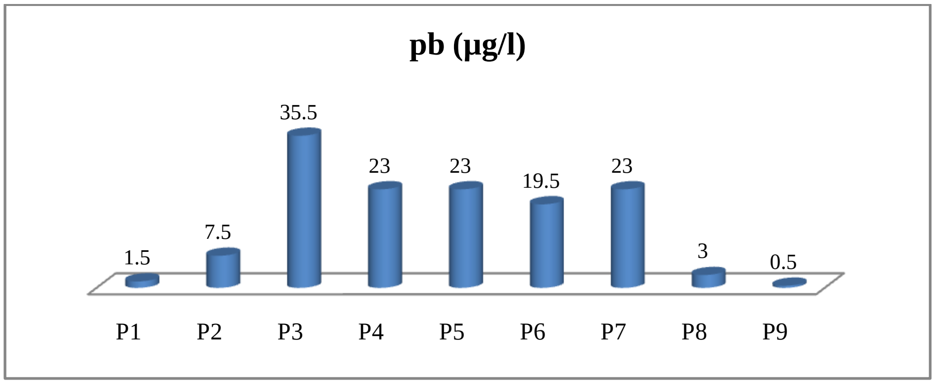


*Figure 5: Spatial variation of the average Pb contents of the oulja wells*

**2.6. Cobalt (Co)**

The mean cobalt contents are between a minimum value of 9 µg / l detected at well 4 and a maximum observed value at well 8, which is 62 µg / l . This fluctuation in grades may be due to spatio-temporal factors. Most of the wells had mean levels below the guideline value (50 µg / l).

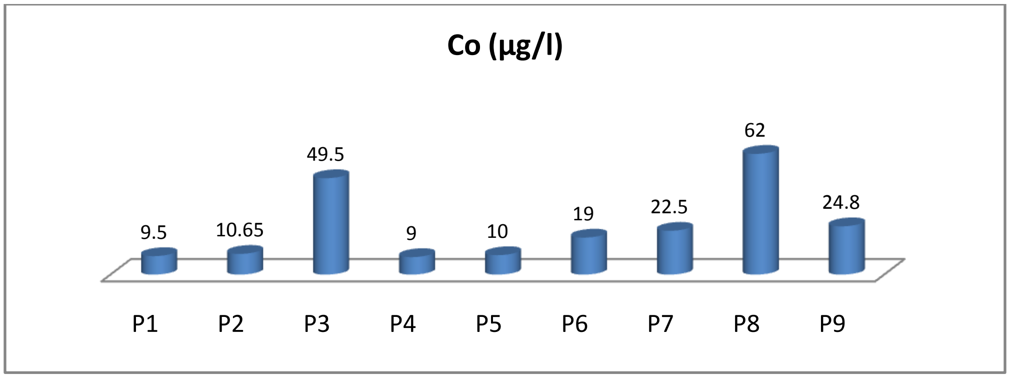


*Figure 6: Spatial variation of mean Co values of wells*

This concerns water intended for irrigation (Moroccan standards). This content does not include well 8 whose waters slightly exceed the normal value presented by Moroccan standards. Thus, we can say that the source of contamination in this element may be linked to the return of irrigation water loaded with fertilizing matter which infiltrate directly to the water table.

**2.7. Zinc (Zn)**

The wells analyzed have fairly low grades and are below the imperative value of irrigation-friendly water (2µg / l). According to Moroccan standards see figure (7). Moreover, the values found for zinc do not show any anomalies involving the quality of the sampled waters.

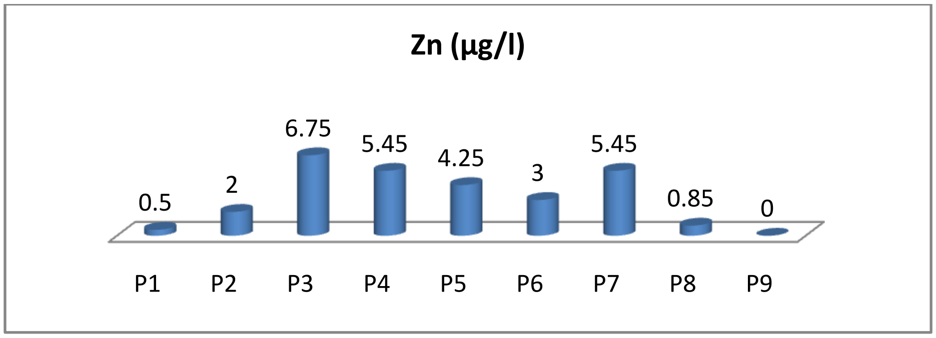


*Figure 7: Spatial variation of the average Zn contents of the wells*

### 2.8. Manganese (Mn)

According to figure (8), it can be seen that the maximum content of manganese found is about 13.5 µg / l at well 5. This value is lower than the limit value of the water intended for the production of drinking water (500 µg / l) according to Moroccan standards and still less than the imperative value of the waters favorable to irrigation (200 µg / l) .These waters are classified according to the Moroccan water quality grid in a good class <100µg / l.

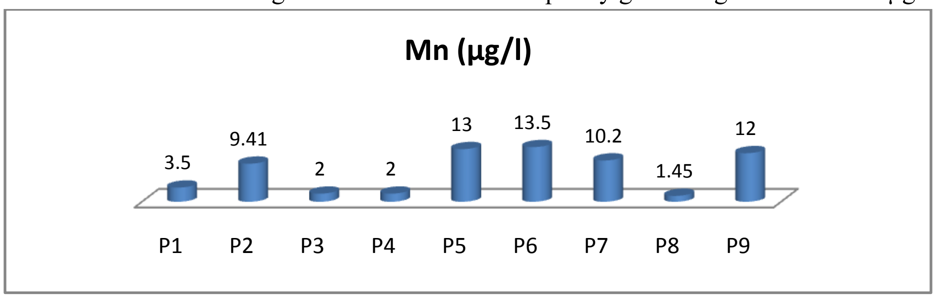


*Figure 8: Spatial variation of the average Mn content of wells oulja*

### Conclusion

By way of conclusion, the contents of metallic elements generally do not vary greatly between the waters of the wells. In this respect, we can note that only cobalt, chromium, cadmium and copper cross the threshold of the Moroccan standard set for irrigation or drinking water by their high values. These are found in some wells that affect the quality of the water.

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