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SUPERFICIAL POLLUTION OF QUATERNARY SOILS OF THE CITY OF ALI MENDJELI, CONSTANTINE, NORTHEAST OF ALGERIA

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The superficial soils of the city of Ali Mendjeli, located in the department of Constantine North-East Algeria, are characterized by decalcification clays, resulting from the alteration of limestone rocks and plio-quaternary marls. The set of analyzes carried out on these soils, calcimetry, particle size, DRX, show a dominant calcium component, clay aggregates packed by carbonate cement. X-ray diffractometric spectra show a dominance of $CaCO_3$, as an essential mineral. They also show the presence of pollution by the elements: Pb, Zn, and Cu, caused by anthropogenic factors such as washing and maintenance of vehicles and machinery during the installations of the various building and road sites that have marked this new city. Their presence is confirmed, but the values as a function of time vary from one point to another. These indications of surface pollution require further analysis of groundwater in lower areas, exploited by farmers and local residents.

***Keywords**: Clays, decalcification, Soil, Ali Mendjeli, Pollution*

INTRODUCTION

The new city Ali Mendjeli is considered a solution to raise the problem of housing in the city of Constantine, it occupies a vast rocky plot ideal for building, these plio-quaternary rocks are covered by a thin layer of marl and clay of up to 2 meters. The installation of the construction sites during the works left traces of pollution due to parks of the various machines.
Our goal is to show that these small temporary installations leave behind polluting elements in the superficial soil.
The new city Ali Mendjeli is located in the southwest of the wilaya of Constantine (Figure 1). It is between 36°13'38" and 36°17'04" North latitude and between 6°32'38" and 6°35'53" East longitude, with a total area of 1711.39 ha and a warm and temperate climate. [1].

Geological context

The region of Constantine is part of the external zones of the Maghreb, external domain, they are characterized by the slip thrust fault essentially in southern vergence, set up during the alpine tectonic phases [3]. It is the product of several tectonic phases [4], the early-tertiary phase [5], [6] and tertiary phases (late Lutetian, Miocene, recent and post-Miocene phase) [7], [8], [9] et [10].
The city of Ali Mendjeli rests on a tray named Ain El Bey, known by lake Plio-Quaternary formations, which is beige to reddish limestone interspersed with marly levels, in the majority of cases these limestones are covered with thin layers of brown to blackish clays of Quaternary age.
The result of a quaternary alteration phase in the presence of a vegetation cover (formation of complexolysis) gave decalcification clays.

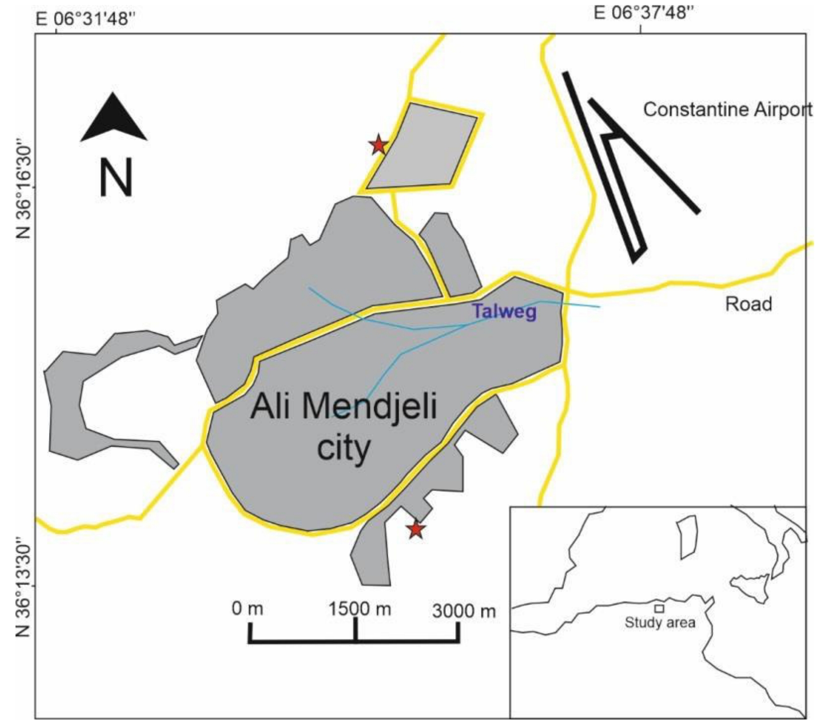

Figure 1. Localisation of the study area, the red stars shows the sampling area [2].

METHODOLOGY

Two sampling zones were chosen on the extremity of the city listed upstream of the watershed to the southwest and northeast. Sampling was carried out systematically from the soil surface to a depth of 1 metre. The loose samples, recovered, underwent particle size, geochemical sedimentometric and mineralogical analyses. The equipment used a series of sieves, a sedimentometer, a Bernard calcimeter and an X-ray aux diffractometer (Philips Xpert pro) equipped with a copper anticathode.
The clay samples analyzed by diffractometer were subdivided into three parts (raw and the other two underwent treatment with ethylene glycol and heated it to 550 degrees). The spectrum processing was done by PANalytical X'Pert HighScore 2 version 2014. An X-ray fluorescence spectrometer (Epsilon) for the estimation of heavy metals.

RESULTS AND DISCUSSION

The in-situ description shows a clear passage of sedimentary levels, the black surface layer followed brownish to beige layers, limestone slabs surmount in some places which suggests a lateral passage of facies. (Figure 2)
The results of particle size and sedimentometry show the following classes 50% clays 20% silts and 30% sands. The observation under the binocular magnifying glass shows the grains mostly fine, the silts and sands present debris of limestone rocks, carbonate nodules and iron oxides.
The carbonate content of these sediments varies from 40 to 80%, which indicates the link between the source rock and the surface soil. Limestone nodules, granules, whit spots are present. Clay aggregates are weakly cemented by carbonates.

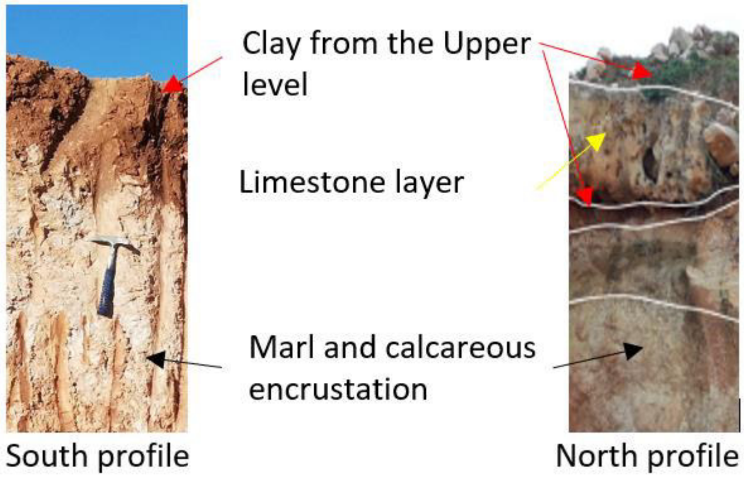

Figure 2. Upper clayey level above the calcareous encrustation (marl)

Analysis of diffractometric spectra by Xpert hight score (Figure 3) shows the dominant minerals Calcite, $CaCO_3$; Dolomite, $Ca(Fe,Mg)CO_3$, followed by secondary minerals such as Quartz SiO_2 of detrital origin, transported by wind. Iron oxides Hematite Fe_2O_3, Siderite $FeCO_3$, iron hydroxides goethite $FeO(OH)$. The clay minerals present are Chlorite, Kaolinite, Illite

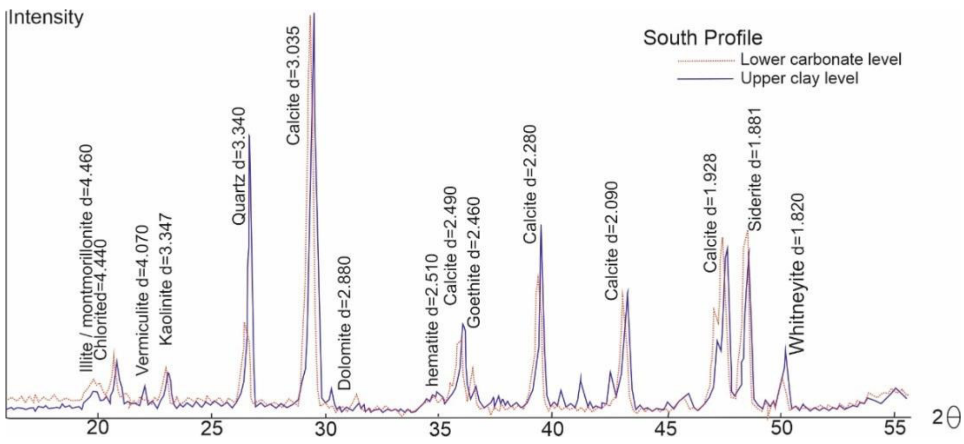

Figure 3. South profile diffractometric spectra

These mineral elements are either inherited from the source rock (marl or limestone) derived from pedogenesis in the presence of complexolysis (vegetation) exchange between soil-plants [11], [12], [13]. Clay minerals testify to the temperate climate (precipitation and snow in winter and dry season in summer [14], [15], [16]. The essential polluting metals observed on the XRD spectra and on the XRF analyses are Plomb Pb with a rate of 0.011-0.012 in two profiles, Zinc Zn is 0.122 in the south to 0.143 in the north, Chromium Cr has low values, Copper Cu the most abundant metal with values of 0.198 in the south and 0.188 in the north, the presence is certain with variable rates from one sample to another, their values increase in surface and decrease in depth. It is noted here that the presence of copper is probably also due to the containment of the sedimentation medium and not only to pollution. [17]. While the other elements, Pb and Zn have had to wash machines and vehicles in maintenance parks, exhausts of Combustion Gas, these elements move on the surface of the ground by the effect of leaching and runoff of rainwater. Recently washing stations have been set up in this city and discharge their partially polluted water directly to the surface of the ground and which will be driven by the tires of vehicles and redeposited in other points. (Table 1)

Table 1. Essential heavy metals in surface soils of the South and North profile

Samples Conc unit %	Cr	Cu	Zn	Pb
South profile	0.001	0.198	0.122	0.012
North profile	0.001	0.188	0.143	0.011
WHO standards %	**0.005**	**0.200**	**0.300**	**0.001**

CONCLUSIONS AND RECOMMENDATIONS

The study conducted on the superficial clays of the city of Ali Mendjeli, Constantine in the North-East of Algeria aimed to determine the physical and geochemical characteristics, the thing that led us to make an overview of the pollution of these clays is the presence of certain metallic elements in the surface sediments, such as Pb and Zn, Cu...

This pollution is only the beginning, because this city is very young, and small industries are starting to develop. Our findings on pollution and on upstream points to see the minimum of pollutants in the sediments, and despite that it is present. Further in-depth studies with extensive analysis are needed to identify the risk of pollution in the downstream parts of the watershed that use the groundwater table for agriculture.

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