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MINORS AND TRACE ELEMENTS DISTRIBUTION IN PHOSPHATE DEPOSITS USING X-RAY FLUORESCENCE

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- Materials and Methods
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Introduction & Problematic

Algeria is one of the countries where the exploitation of phosphate deposits is of great economic interest; its annual production is 2 to 3 million tons. These quantities are mainly distributed over 4 or 5 phosphate deposits.

Algerian phosphates are considered to be a sedimentary phosphates, which are used largely for the manufacture of fertilizers and phosphoric acid.

Introduction & Problematic

Algerian phosphates contain major, minor and traces elements.

The characterization of phosphates has an important rules for study of the distribution of these elemements in phosphate deposits.

Objectif

- Characterization of Algerian phosphate
- Evaluation the distribution of minors and trace elements in different geological layers of the phosphate mine.

Materials and Methods

Study Area

The region of Djebel Onk is located in the south-east of Algeria, 100 km from the wilaya of Tébessa and 20 km from the Algerian-Tunisian border.

Materials and Methods

Sampling

Sampling was carried out in collaboration with engineers from SomiphosTebessa.

Three samples were taken from the kef essnoun deposit and transferred to the laboratory for treatment.

Materials and Methods

Sample Preparation

Crushing

The samples were firstly reduced using a jaw crusher to a particle size of less than 8 mm.

Materials and Methods

Grinding

Using a disc mill, samples were crushed to fine diameter (less than 0.1mm).

Materials and Methods

Sieving

After that , the phosphate samples were sieved to recolt the fine particles for ED-XRF measurement.

Materials and Methods

Conditioning

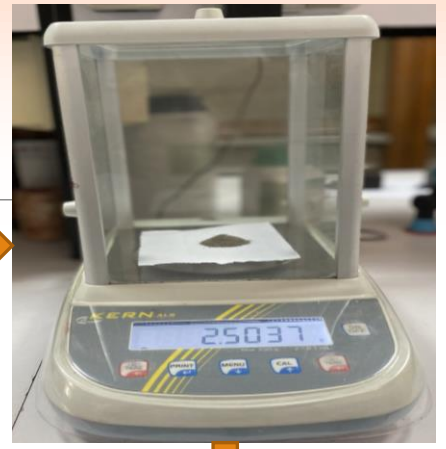
The phosphate samples were packaged and sealed in sample holders to avoid contamination.

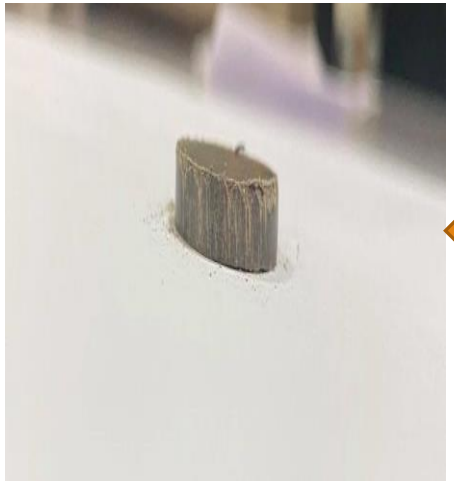
Materials and Methods

ED-XRF measurments

The sample must undergo grinding using a mortar to homogenize to powder .

A quantity of 2.500 mg phosphate samples were pressed under a pressure of 18 tons to obtain a pellet with a perfectly smooth and homogeneous analytical surface for analysis by X-Ray spectrometry.

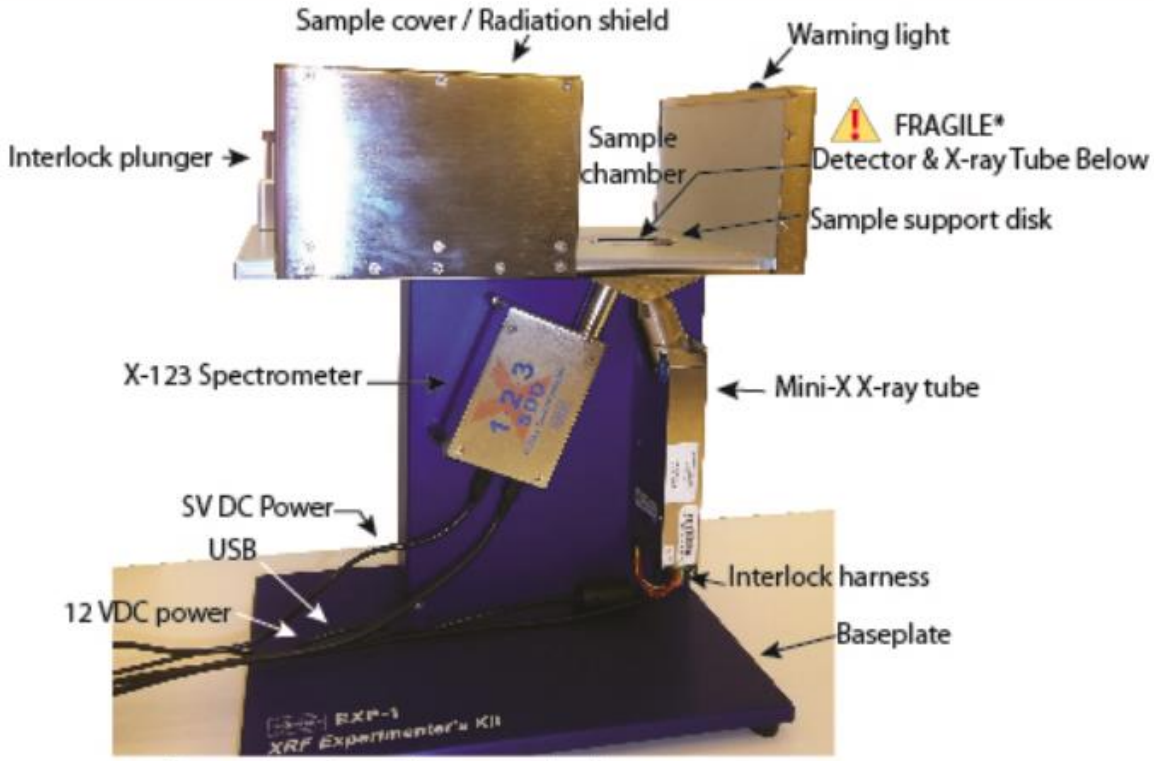




Materials and Methods

The energy dispersive X-Ray fluorescence used in this work is compound:

- SDD (Silicon Draft Detector) of 25 mm^2 active area and silver anode, with a resolution of 130 eV at 5.9keV of Ka of Fe-55.
- The energy excitation is 30 keV generated by 30 kV high voltage and a maximum curent of 25 μA.
- Three filtres Aluminium, Molybdene and Copper for low energy X-Ray absorption to reduce the bremsstrahlung.
- The system is controlled by a computer equipped with analysis software.



Materials and Methods

Measurments and quantitative analysis

Each samples were excited during 300 sec with several absorbing filters to obtain a good detection limits.

The phosphate X-Ray spectra were analyzed using AXIL software.

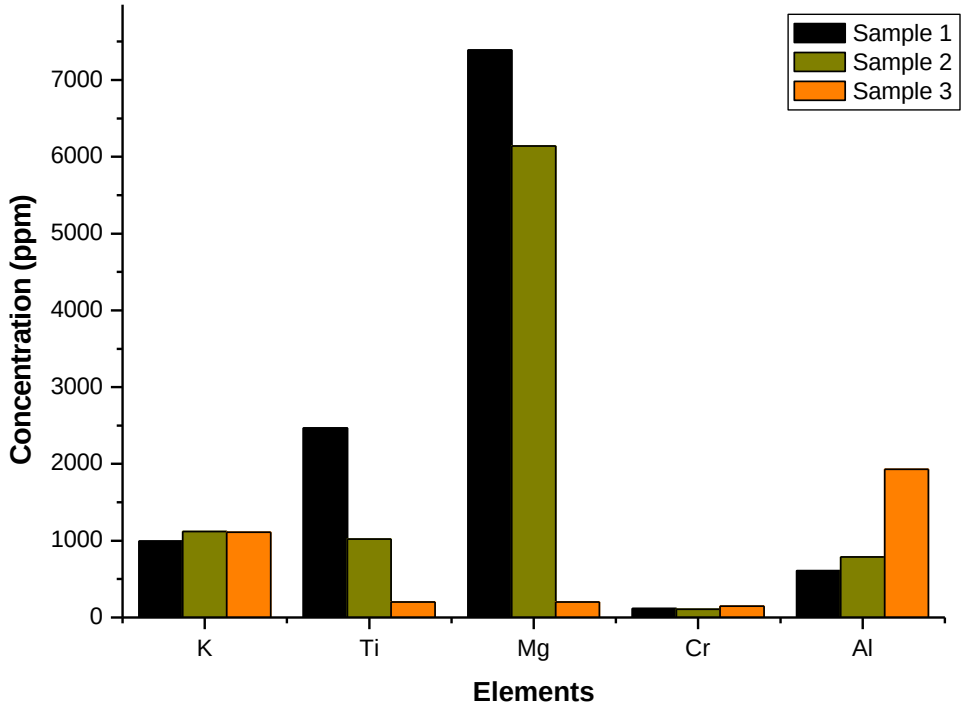
The minors and the trace elements concentrations where determinated using a phosphate external standard according the following formula :

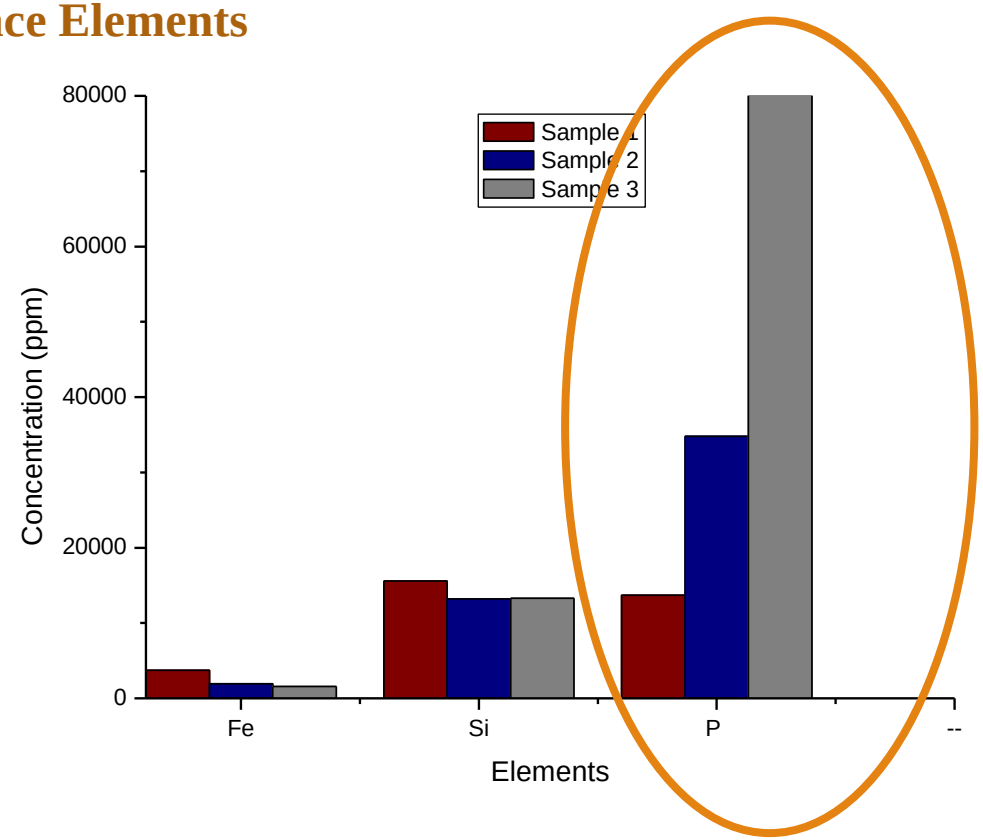
$$Cx/Cstd = Ix/Istd$$

Results and discussion

Distribution of Minors and Trace Elements

According to the concentration distribution in three sample given in figures

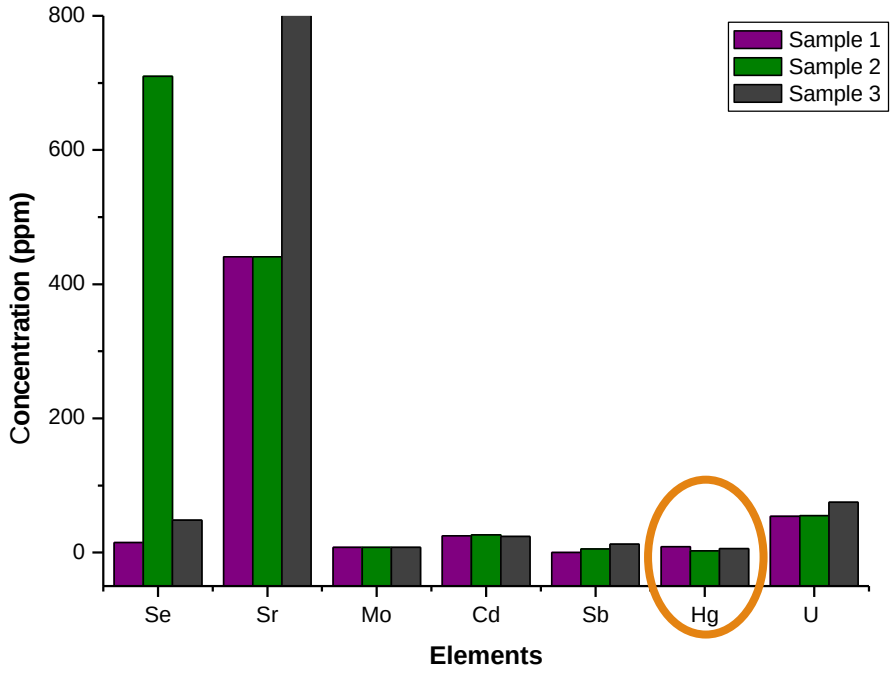




The variation of Phosphore concentration is about 8000 ppm

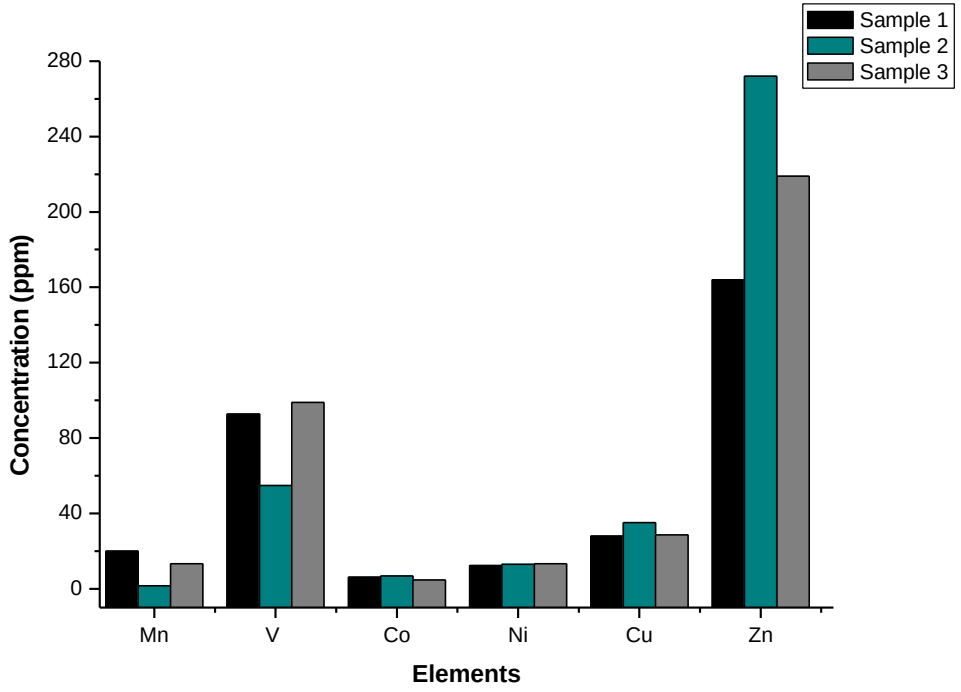
Results and discussion

Distribution of Minors and Trace Elements



Mercury about 2.51 ppm (trace element in phosphtes).

Uniform distribution for heavy element



Results and discussion

The ED-XRF is multielement, non destructive and very quickly technique, however this technique prensent dificults methodology for determining a low conentration in geological matrix like phosphats. This problem is related to matrix and enhancement effect in X-Ray fluorescence analysis of environmental samples of medium thickness.

Conclusion

- The characterization of three samples of phosphate by energy dispersive X fluorescence (ED-XRF) revealed the presence of several heavy trace elements and many minor and major elements.
- The results of this study also showed the presence of these elements in different geological layers of the Kef Esnoun deposit.
- This first study is considered as a baseline to assess the level of heavy polluant element in the environment and the impact on the populations of this region.

Thank you for your attention