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Multifractal characterization of the visual spatial pattern of the disturbances of phosphate series through the geoelectrical maps (Sidi Chennane, Morocco).

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INTRODUCTION

The phosphate series of Sidi Chennane suffer from inclusion of many sterile bodies composed of a waste rocky material that must be removed. These bodies called disturbances create many real problems occurring in Sidi Chennane phosphate mine during the mining operations [1].

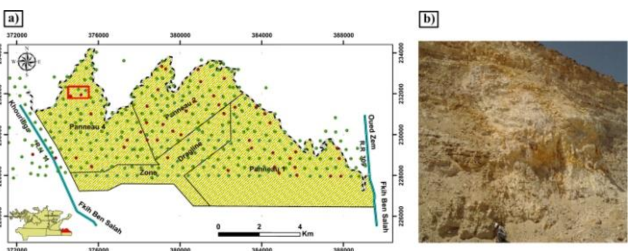

***Figure 1:** (a) Sidi Chennane phosphate deposit (red point present disturbed boreholes while green point present not-disturbed boreholes), (b) Section of phosphate sequences fronts demonstrating a disturbance.*

In this study, we intend to numerically quantify the visual look of geoelectrical maps in order to automated diagnosis the maps and quantitatively describe the disturbances pattern so that a control strategy can be developed. We are motivated regarding the benefits and the potential diagnostic utility of the multifractal analysis in the automated assessment as a general method for analyzing the texture and spatial distribution.

MATERIALS AND METHODES

The multifractal analysis include the generalized correlation dimension D(q), the mass exponent τ(q), the singularity exponent α(q), and the local dimension (or Hausdorff dimension) f(α) [2].

The analysis was applied on a set of 5151 geoelectrical data acquired from an area of 50 hectares in Sidi Chennane phosphate deposit (Fig. 1). The geoelectrical anomalies are used as a marker for distinguishing between the disturbances and the phosphate rocks (disturbances correspond to a resistivity exceed 200Ω.m).

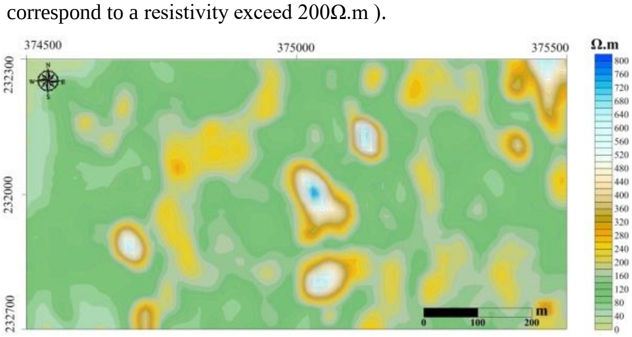

***Figure 2:** (a) Sidi Chennane phosphate deposit (red point present disturbed boreholes while green point present not-disturbed boreholes), (b) Section of phosphate sequences fronts demonstrating a disturbance.*

Quantitative variation of the disturbances was made by extracted the disturbances boundaries at different cutoff apparent resistivity frequencies (υ_{ar}). This way of doing allow observing to what extent the surface of the disturbance changes across the study area as a function of the geoelectrical anomalies character.

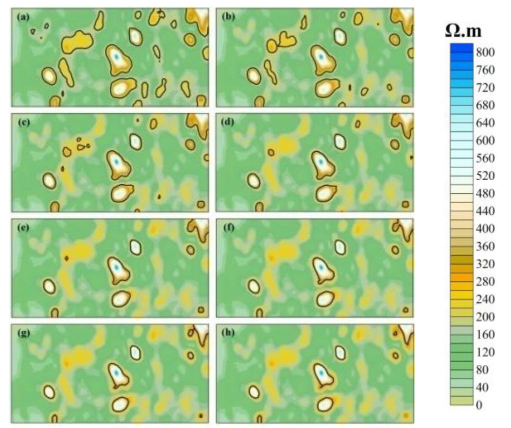

***Figure 3:** Spatial patterns of the disturbances extracted through the geoelectrical anomalies for eight different cutoff frequencies $\upsilon_{a.r}$: (a) $\upsilon_{a.r}$ = 200Ω.m; (b) $\upsilon_{a.r}$ = 220Ω.m; (c) $\upsilon_{a.r}$ = 240Ω.m; (d) $\upsilon_{a.r}$ = 260Ω.m; (e) $\upsilon_{a.r}$ = 280Ω.m; (f) $\upsilon_{a.r}$ = 300Ω.m; (g) $\upsilon_{a.r}$ = 320Ω.m; (h) $\upsilon_{a.r}$ = 340Ω.m..*

RESULTS AND CONCLUSION

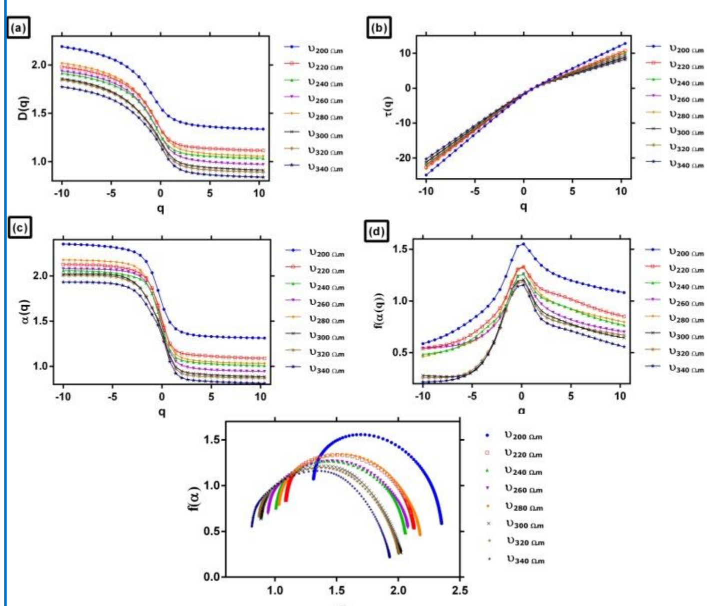

***Figure 4:** Multifractal spectrums behaviors.*

The plotted multifractal spectrums was describing the scaling behavior of the disturbances within eight contrasting patterns and provide results sensitive to small changes.

This analysis could be relevant to observing, describing and analyzing the disturbances. It may represent a step forward towards the phosphate reserve estimation.

REFERENCES

[1] S. Bakkali, M. Amrani, *Earth. Sci. Res. J.* **2008**, 12, 62-71.
[2] B. Mandelbrot, W. H. Freeman, *Earth. Surf. Proc. Land.* **1983**, 8, 460.