Uses of multiscale fracturation study approach to estimate artificial groundwater recharge in arid regions (example of Segui region, south of Tunisia)

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INTRODUCTION

The south of Tunisia characterized by arid regions are characterized by scare groundwater resources due to its location near the Gafsa accident, which is a segment of the regional tectonic accident of the South Altas in Tunisia, and by bad quality of phreatic aquifer. Prospecting new groundwater resources in carbonate geological formations become necessary to ensure alimentation of inhabitants of this region for drinking and for agriculture activities to ensure sustainable development in region.

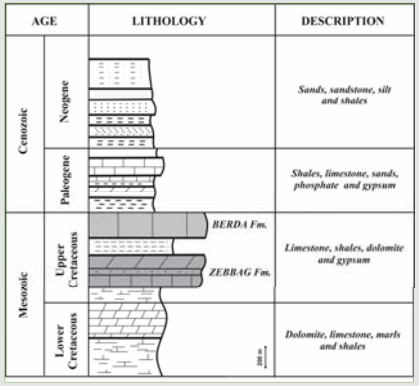
Field observations show that exist direct relationship between fracturation; regional faults or metric fractures, and groundwater flow in carbonate aquifer. We proceed for multiscale study of fracturation to understand this relationship and estimate groundwater management.

METHODOLOGY

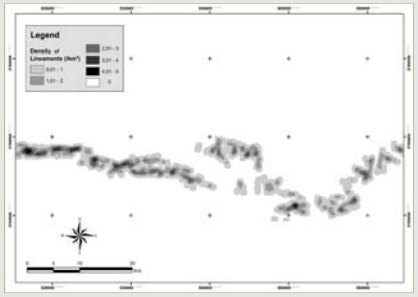
- Extraction and cartography of lineaments et des geological accidents using ultimate LandSAT imagery (L8 OLI / TIRS).
- Field verification and confirmation.
- Metric fractures measurement in field using statistical approach by quantitative and qualitative analysis methods. (frequency, m spacing, density, aperture etc…).
- Geological, Hydrological and Hydrogeological synthesis.

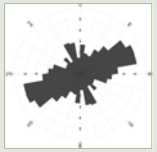
(1) - UR13ES26, Paléoenvironnement, Géomatériaux et Risques Géologiques, Faculté des sciences de Tunis, Université de Tunis El Manar, 2092, Tunis, Tunisie

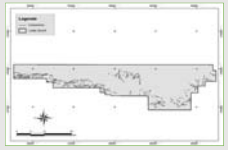
GEOLOGIC SETTINGS



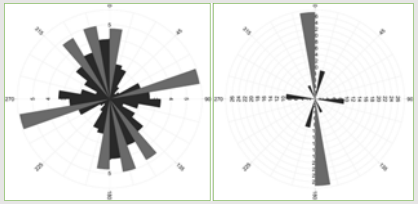
SAT IMAGERY ANALYSIS







OUTCROPS FRACTURES ANALYSIS



It is metric scale. Fractures measurement proceeded with 1m^2 (1m x 1m) in carbonate benches outcrops of Late cretaceous. Especially carbonates of Cenomanian-Turonian and Maastrichtian.

HYDROLOGY AND HYDROGEOLOGY

- Arid climate
- Poor precipitation
- Moderate wind
- Large drainage system
- Important carbonate aquifer
- Good groundwater quality

RESULTS AND DISCUSSION

Lineaments have main direction of ENE-WSW and N-S.

Metric fractures have pseudo-random spatial distribution, with a spectacular N-S direction. Density of this one become very important near lineaments corridor.

Fractures can be considered like promoter of groundwater circulation.

Lineaments have the role of threshold of aquifer. Faults corridor delimits groundwater circulation an lateral aquifer expansion.

Faults engender, in most situations, a topographic anomaly and contribute to creation of drainage lines.

The importance of fractures in subsurface is observed in hydrodynamic parameters of aquifer (high transmissivity and storage coefficient) and in logging results.

Spatial distribution of metric can help recharge of deep carbonate aquifer.

The importance of large outcrops surface and weak dip of geological benches can be an important parameter.

Proposition of potential cites of recharge is based on combination of density and direction of faults and metric fractures. These parameters are generally superposed with drainage lines,

Suggestion of recharge methods is based on climate characteristics and type of aquifer.

Two methods of recharged are adopted: injection method is suitable for arid region and infiltration methods with a small mobilisation structure is important to reduce evaporation surface.

CONCLUSION

Observations and results of this study show that fracturation with its different scales have un important in groundwater circulation and flow control.

These parameters can help in assessment of groundwater by recharge methods.

Spatial distribution of fractures in different scale, with integration of various parameters; climatic, topographic, hydrologic, geologic and hydrogeological can be helpful for this study and favour this gait.

It is important to proceed artificial recharge to avoid actual excessive exploitation and management of groundwater resource to ensure sustainable development in these arid regions,