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PROBLEMS OF SALINIZATION IN THE MZI VALLEY AQUIFER (LAGHOUAT, ALGERIA)

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ABSTRACT. The use of the Mzi valley groundwater resources for Laguouat, a city of 25000(inhabitants in Souhtern Algeria at the edge of the sahara desert, is limited not only by low reserves but olsc decreasing quality.
As a result of severe climatic conditions and the particular geological envirenment, groundwater aquifere: come naturally to the surface as ponds with cor··iderable salt content. These salty waters might be the source of contamination when modifications to dyn..mic equilibrium take place, especially in connection witl pumping rates.

The Mzi valley is a 300 Km2 basin located West of Laghouat, bounted to the North by the saharier plateform, the dayas, and to the east by the Kabeg ponds. Geologically, the basin was formed by th combination of two phenomenon:
- A regressif erosion from the south aurassian chott base level whitch was subsident until a recent period Villafranchian).
A tectonic vertical deformation which explains the strong topographical and hydrographical deformations.

REGIONAL GEOLOGY (Fig 1)

Sedimentary series of the basin are of the Mesozoic, Cenozoic and quaternay age. Triasic formation outcrop along local accidents. A short stratigraphic description can be given as follow.
Jurasic formations are seen in the center of anticline of NE-GW axis (Djebel Lazreg and Djebel Ain Mahdi Recent stratigraphic studies (Abed S. and Herkat M. 1982) chowed for series :

* El Bayadh series (Bathonian and callovo-oxfordian) with :
  - 400 meters of silty clays.
  - Carbonated, micaceous pyritaceous silty clays.
  - White sandstones with brachiopodes.

* El Brezina series (Kimmeridjian)
  Subdivided in two reef subseries with an intermediate zone (carbonated marls and sandstones).

* Laghouat series (upper Kimmeridjian to lower Portlandian)
  The tickest formations in encountered in Djebel Lazreg (1 300 meters).
  Two other facies are observed:
  - Mrls With lummachellic intercalation.
  - Gypseous marls.

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* Ain Rich series (upper Portlandian)
characterized by two formations :
180 meters of gypseous marls and oolitic limestone foramtion.

Most of the cretaceous formations are outcroping in the region, essentially in perched syncline, as opposed to Jurrassic ones where two geologic stages are missing, the Lias and the Dogger.

Lower cretaceous in essentially composed by sandstones found in large depressions between syncline and anticline. The particularity of sandstones is the presence of pills.

Upper cretaceous is evaporitic, clayey and carbonated and constitutes main perched syncline which center is filled with tertiary slating.

After surection of Saharians Atlas, a preatlasic trough is forming at the Atlas step and then filled with detritic sediments.

Tertiary formations can reach 600 meters of thickness with very quick lateral facies variations. From bottom to top we encounter :

- 30 meters of clays and sandstones.
- 250 - 300 meters of clays, sands and sandstones with rare lacustine limestones.
- Gross dietritic series, conglomeratic at the base and the changing to red sands at the top during quaternary one can distinguish three periods:

Ancient quaternary subdivided in two different morphological level :
High surfaces with conglomerates of limestone cement.
Glacis with thick calcariferous crust and pebbles.
Middle quaternary during which two glacis were formed.

Recent quaternary with formation of new morphological level during climatic oscillations.

TECTONIC :

Central Saharian Atlas is characterized by rigid and flexible deformations typical of a complex shear zone.

Anticline and syncline oriented roughly SW-NE characterize two zones:

- a meridional zone with typical perched synclines of large flat bottom. The center of which contain upper cretaceous and tertiary continental formations :

Djebel Dakhla syncline.
Djebel Mi k syncline.
Djebel El Houita syncline.

- A septentrional zone with narrow anticline, elongated and with flat center of jurassic formations:

Djebel Lazreg anticline.
Ain Mahdi anticline.

Sedimentation and deformations were largely conditionned by thrusting occuring during secondary and tertiary eras. Most frequent faulting direction is E-W.

South Atlassic flexure, appears as flexure, fault or disrupted fold materialised by low reliefs (Djebel Sid Yagoub.....). Emplacement of flexure zone were precised by gephysical methods of prospection.

Geophysical studies (electrical sounding and logging analysis) and data from borings (Fig. 2) led to the following classification:

- An alluvial superficial aquifer made of gross sands, gravels and pebbles.
- A deep aquifer in charge in lenticular sedimentation made of fine sands, gypsum and some lacustrin calcareous elements.
- A semipermeable level of red clays with fine sands in between.

HYDROCHEMISTRY :

Mzi valley waters are essentially of sulfate, calcium and magnesium composition and become sulfate sodium and chlorine magnesium in Kabeg.
Deep borings F14 and F15 showed that miopliocene terrains can present pockets of salty waters (over 1 g/l).
In the Mzi valley, soils are fluvio- eolian origin and a real pedological cover was formed over its low topography. It is today, an essentially agricultural region with low precipitations (150 mm/year) and an average temperature of 23 degree celcius wich explains that this presaharian region is arid.
In order to supply the increasing population (increasing demography and urbanization) with water and to be self-sufficient, the local community decided a vast program of borings (Fig. 3) and a land valorization Over 50 borings and 1000 wells were implanted which led to an intensive pumping rate. The consequence of this unorganized and uncontrolled pumping is felt with a drawdown of the alluvial aquifer level (Table 1 and a chemical evolution of water quality.
Piezometric and equal drawdown maps, and succesive profiles chow a general lowering of water table and formation of two pumping cones. the lowest level is seen in Mekhareg and Ksar-El-Hirane wells with respectively 10 and 8 meters.
Extension of pumping cones and the salinization of water in the Kabeg pond region led us to study the movement of salt water in the deep aquifer.
Water analysis, diagram during pumping, crop differenciations and salts deposits, high salt level was confirmed. The solute transport study will try to explain the overexploitation aquifer in the Mzi valley.

Our aim is to propose a bidimensional model of solute transport and dispersion. We will try to quantify the risk of salt contamination and predict the movement of salty water within the aquifer. It wase a simple exchange by convection dissolved matter according to the dispersion theory. We schematize the phenomenon involved by limiting ourselves to a description of the salt movement within the aquifer and regarding the concentration of salt as constant.

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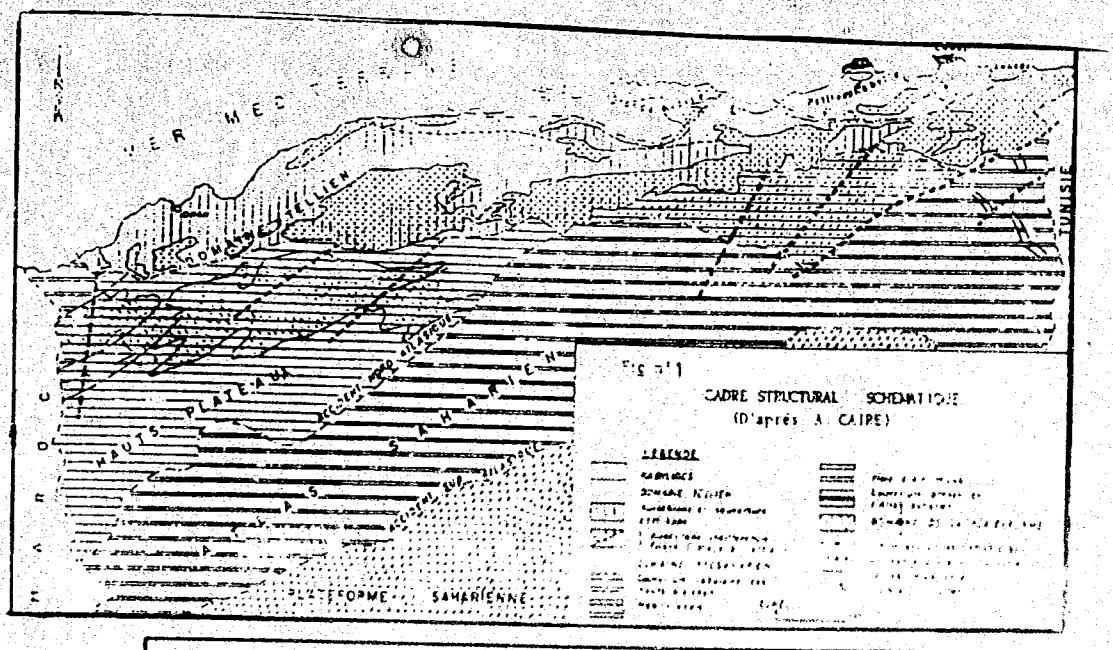

Fig n°1

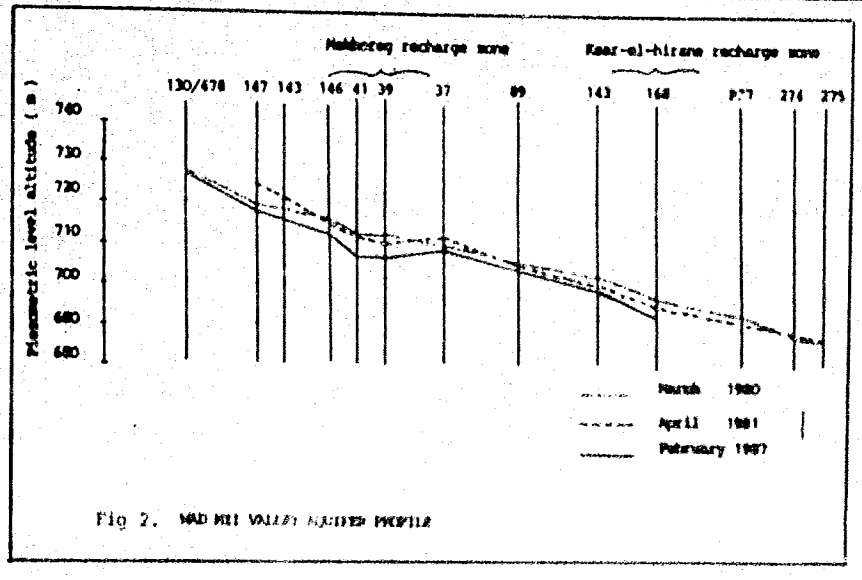

Fig 2. MAD MEL VALLEY AQUIFER PROFILE

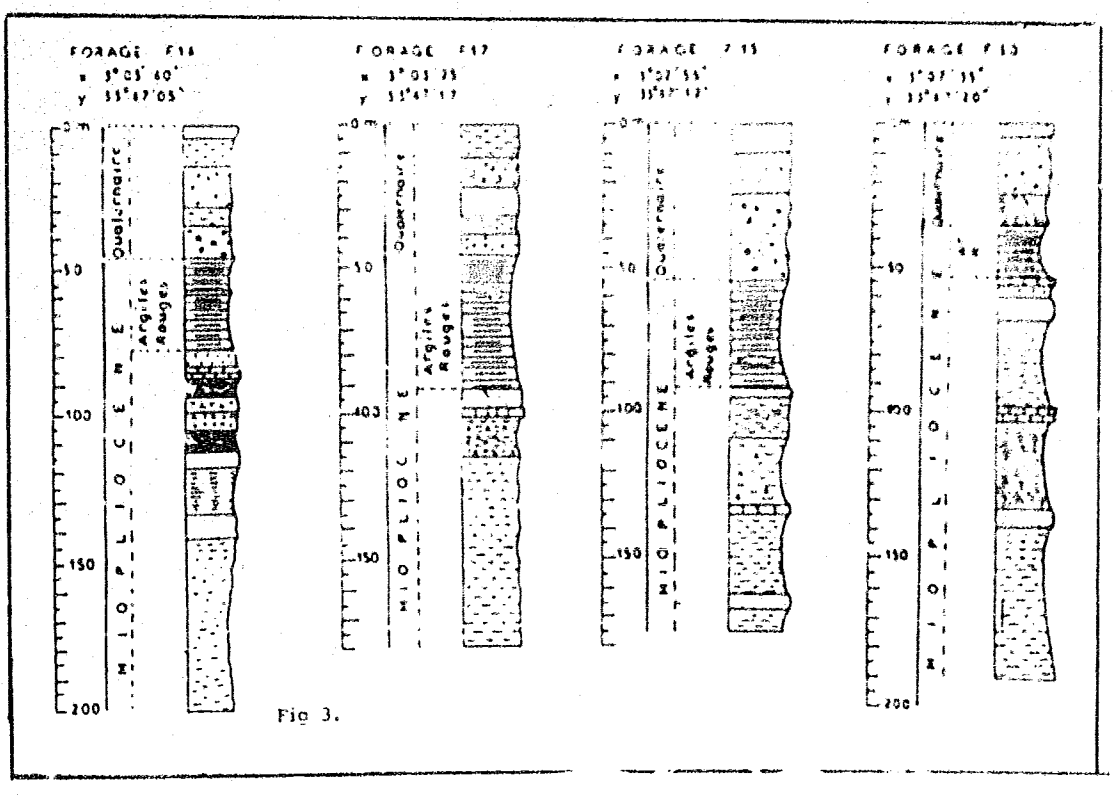

Fig 3.

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	Étiquette	Données (à dactylographier)
Auteur (s) Personne physique (Affiliation (s))	100	Mimouni, O.; Chattih, A. (Univ. of Algeries (Algeria). Dept. of Hydrogeology); Tadj, A. (Direction Hydraulique
~~Collectivité(s)~~ auteur(s)	~~110~~	de la Wilaya, Laghouat (Maroc))
Titre universitaire	111	
Titre anglais — Titre principal	200	Problems of salinization in the Mzi valley aquifer (Laghouat, Algeria)
Titre anglais — Éléments secondaires	201	
Réunion — Nom	210	Hydrogeologie des Milieux — —
Réunion — Lieu	211	Marrakech (Maroc)
Réunion — Date	213	22-25 AVR 1992
Titre original (Translit.) — Titre principal	230	[Problemes de salinisation dans l'aquifere de la Vallee de Mzi (Laghouat Algeria)]
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Notes	610	3 figs. 6 ref.

2

009 S (Niveau)

	Étiquette	Données
Titre de publication en série — Titre principal	230	Revue de la Fac...
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Collation	500	No special p. 200-203
Notes	610	

3 009 | 9 | / | EN | 009 | 9 | / | ES | 009 | 9 | / | (FR) |

Code de langue des descripteurs (cercler obligatoirement celui qui convient)

	Éti-quette	Données (à dactylographier)
Descripteurs AGROVOC pour l'index matière dans Agrindex	800	NAPPE SOUTERRAINE; SALINITE; ANALYSE DE L'EAU; ALGERIE (PRIMAIRE) (Séparer les descripteurs par un point virgule (;) et un espace, faire précéder les propositions de nouveaux descripteurs par un point d'interrogation (?))
Autres descripteurs AGROVOC		/ (laisser un espace après la barre oblique (/))
Commentaires sur les descripteurs existants ou proposés	810	

4 009 | 9 | / | | |

Code de langue des termes d'indexation

Termes d'indexation du vocabulaire local	820	

5 009 | X | / | FR |

Code de langue du résumé

Langue du résumé en clair	850	
Résumé	860	Vus les conditions climatiques sévères et l'environnement géologique particulier de la Vallee Mzi, les eaux souterraines de cet aquifere montent en surface avec une teneur considerable en sel. Ces eaux salees peuvent etre une source de contamination en cas de modification de l'equilibre dynamique, specialement en connexion avec le reglage de pompage.

FIN

النهاية

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VUES

مشاهد