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# FORAMINIFERAL BIOSTRATIGRAPHY AND PALEOENVIRONMENTS OF THE CENOMANIAN-CONIACIAN ROCKS OF SOME WELLS IN THE NORTHERN WESTERN DESERT, EGYPT.

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## ABSTRACT

*The present work includes a detailed lithostratigraphic, biostratigraphic and paleoenvironmental study of the late cretaceous (Cenomanian-Coniacian) succession in two subsurface wells (Ghoroud IX, Sharib IX) located in the northern part of the Western Desert.*

*According to lithostratigraphic study two formations and nine members have been established: The Bahariya Formation of early Cenomanian which is differentiated into lower clastics Member and upper carbonate Member. The Abu Roash Formation of late Cenomanian to late Coniacian, subdivided into seven members (A to G). Five formaininferal biozones have been recorded. Favusella washitaensis (early Cenomanian), Whitinella baltica (late Cenomanian), Heterohelix reussi (early Turonian), Discorbis turonicus (middle Tuonian to late Turonian) and*

*Dicarinella primitiva (Coniacian). Also the study revealed facies changes, where fluviomarine origin is suggested to the lower bahariya Member, subtidal alternated with shallow marine for the upper member. The Turonian and Coniacian sequences represent a deeper marine environment that becomes shallower upwards indicated by the common occurrence of arenaceous assemblage.*

## INTRODUCTION:

Numerous studies have been done on the subsurface upper cretaceous sequences on the northern western desert to get their facies characteristics among which are:

Said (1962), Beckmann (1967), Norton (1967), aadland & Hassan (1972) El Gezeery & Oconnor (1975), Barakat et al (1988) Darwaish et al (1987), Andrawis et al (1988) Darwaish et al (1989,1994), Bakry (1994), Mahmoud (1994), Ragab et al (1994) and El-Shaarawy, et al (1995)

The present work is mainly concerned with the detail investigation of the formainiferal content of the Cenomanian-Coniacian sequence penetrated in Ghoroud well No. IX (Long : 30° 03' 08" N Lat.:28° 19' 15"E), and Sharib well No. IX (IX (Long : 30° 11' 36" N Lat. :28° 19' 6"E) Northern Western Desert (Fig.1). The lithofacies of the different units have been also discussed and illustrated (Plates 1,2 and 3).

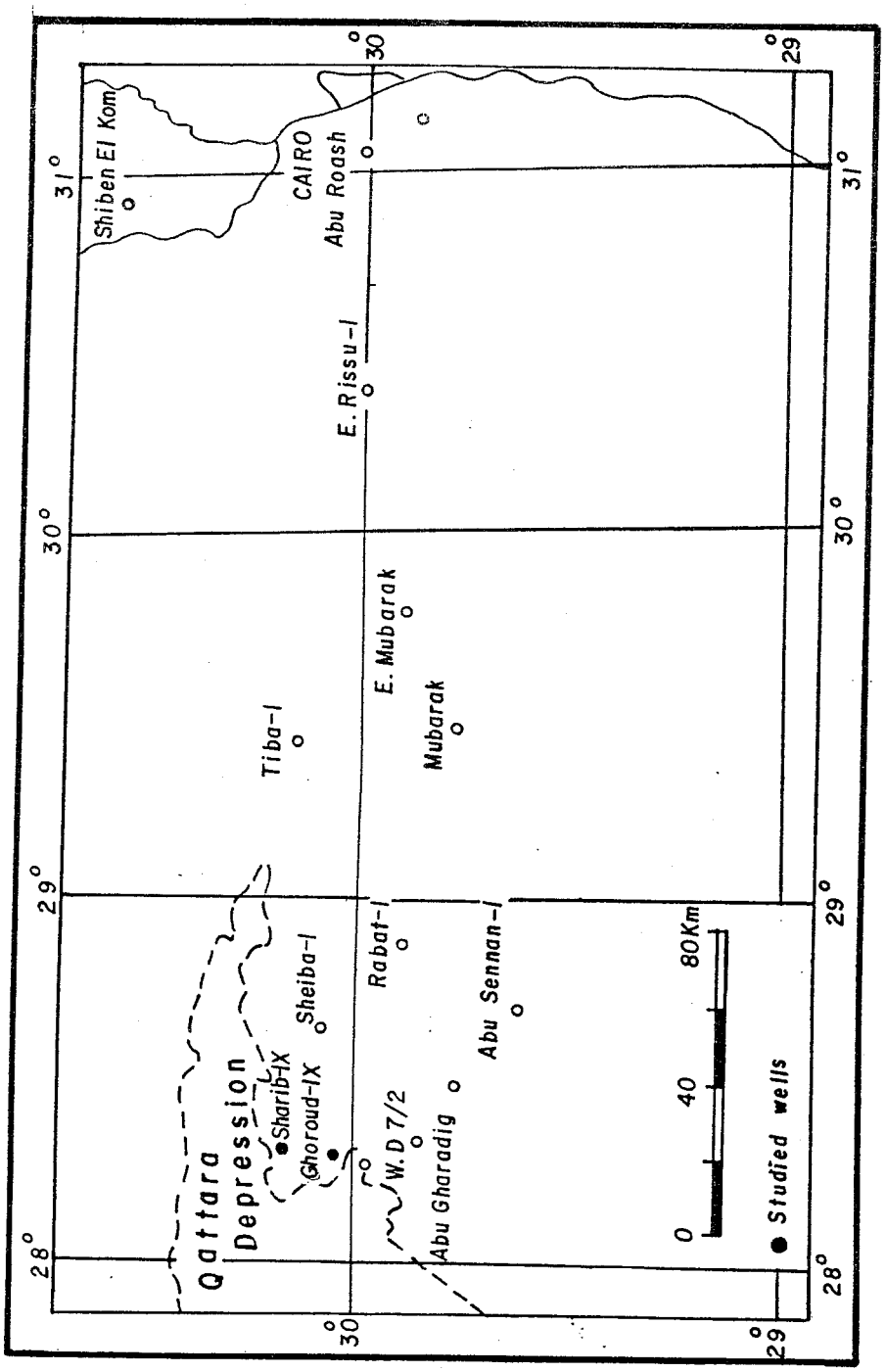


*Fig.(1) Key map showing the location of the studied wells*

The stratigraphical ranges of the identified foraminiferal species in each section are given in figures 2,3.

## LITHOSTRATIGRAPHY:

The stratigraphic succession recorded in the studied wells is from base to top as follows:

### 1. Bahariya Formation: (early Cenomanian):

The formation was first described by Ball and Beadnel (1903) and recorded by Said (1962). It consists of sandstone informaly named "Razzak Sands", intercalated with carbonates, sandstones and argillaceous sediments. It is differentiated into two distinctive members.

The upper member is composed of carbonate and shales, the lower one is of sandstone and siltstone and barren of foraminifera. The formation is conformably overlain by Abu Roash Formation (G Member) and confomably underlain by kharita formaion in Ghoroud well No. IX (Form lithologic log) and unconformably underlain by the jurassic in Sharib well No. IX (from lithologic log). It has 700 feet thickness in Ghoroud well No. IX and 950 feet thickness in Sharib well no. IX.

**2. Abu Roash Formation:** (late Cenomanian-Coniacian):

It is identified by a sequence overlain by the Khoman Formation and underlain by the Bahariya Formation (Norton 1967). It is subdivided into the following members from base to top:

**Abu Roash "G" Member:**

It is conformably overlain by the Abu Roash "F" Member in Ghoroud IX and unconformably overlain by the abu Roash "E" Member in Sharib IX, and conformably underlain by Bahariya Formation. It is consisting mainly of shales light grey, fissile, partly blocky, silty with sandstone interbeds, dolomitic limestone is characterised to it's base. It attains 650 feet thickness in Ghoroud IX, and 450 feet in Sharib well No. IX. It was deposited under inner shelf environment. A late Cenomanian age was assigned to this member.

**Abu Roash "F" Member:**

It is made up of limestone: light brown, medium hard, fine to medium crystalline, highly argillaceous, with shale streaks. It has 250 feet thick in Ghoroud IX. An open marine environment is characterised this member.

**Abu Roash "E" Member:**

Alternation of limestone with shale is representing the member, highly fossiliferous, it has 250 feet thick in Ghoroud IX

and 100 feet in Sharib IX, An early Turonian age was assigned to "F" and "E" Members.

**Abu Roash "D" Member:**

A body of 250 feet of argillaceous, highly fossiliferous limestone in Ghoroud IX is characterised to this member and absence in Sharib IX.

**Abu Roash "C" Member:**

It is composed mainly of highly calcareous and fossiliferous shale with thin streaks of limestone, it is of 120 feet thick in Ghoroud IX and absence in Sharib IX. The "C" and "D" Members are of middle to late Turonian age.

**Abu Roash "B" Member:**

It is mainly consist of light grey to white, medium hard limestone, fossiliferous, it has a thickness of 110 feet in Sharib IX and 210 feet in Ghoroud IX. It belongs to Coniacian age.

**Abu Roash "A" Member:**

This unit is made up mainly of shale intercalated with limestone, A late Turonian-Coniacian age assignment is proposed for this unit, it is 100 feet thick in Ghoroud IX and 150 feet thick in Sharib IX.

**Microlithofacies:**

**Lower Bahariya Member:**

From petrographic investigation, two sandstone microlithofacies have been recognized:

**Calcareous Quartz arenite:**

Well rounded, moderately to well sorted quartz grains set in a sparry calcite cement. The Quartz is single, semi-composite and composite. Rare limestone fragments, patches of bitumenous matter and pyrite aggregates are encountered.

**Argillaceous Quartz arenite:**

Poorly to moderately sorted, well rounded to subrounded quartz grains set in an argillaceous matrix. The quartz is single to semi composite and composite, colourless, and occasionally sheared. Traces of sparry calcite cement and rare phosphatic fragments are occasionally encountered in addition to patches of bitumenous matter associated with pyrite aggregates.

**Upper Bahariya Member:**

From the petrographic investigation of the carbonates of this member, the following microlithofaies has recognized.

**Dolomitized Sandy oolitic biomicrite:**

It is somposed of fine Pelecypod and Echinoderm debris with rare Ostracod tests, and occasional ooids and coated grains with tangential texture and Quartz sand and silt and limestone nuclei.

At parts detrital quartz sand grains are found. The rock is morderately dolomitized into medium to coarse crystalline

dolomite, general laminated texture produced by compaction and pressure solution.

**Abu Roash Formation:**

The following microlithofacies of this unit are:

**Micrite (lime mudstone) to wackestone:**

It is composed of micrite with modertae aggrading recrystallization into a microspar and rare bioclasts including Echinoderm fragments and fine pelecypod debris and occasional planktonic foraminiferal tests.

**Biomicritic wackestone:**

It is composed of planktonic foraminiferal tests and occasional Echinoderms and pelecypod fragments with rare interclasts and glauconite pellets set in partly recrystallized micritic ground mass.

**Limestone with streaks of shale:**

The limestone is in the form of partly recrystallized biomicritic wackestone. It is composed of planktonic foraminideral tests embedded in a micritic matrix which has been variably recrystllized into sparry calcite. Sparry calcite is also present as pore-filling within the foraminiferal test chambers. Rare isolated dolomitic rhoms are occasionally encountered. At parts fine micaceous and chloritic material is present within the ground mass as well as the intervening shale streaks. Rare mica flakes of larger size were encountered.

**Biostratigraphy:**

Five foraminiferal Zones have been established in the studied wells they are from base to top as follows:

*Favusella washitaensis* Zone: (early Cenomanian)

The Zone is 390 feet thick in Ghoroud IX and 375 feet thick in Sharib IX. It yields: *Favusella washitaensis* (CARSEY), *Hedbergella planipira* TAPPAN and *Heterohelix moremani* USHMAN and *Guembelitria cenomana* Keller.

The overall constitution of the above mentioned foraminiferal association suggests a Cenomanian age. The presence of the zonal species points to an age not yunger than the *Rotalipora reicheli* Zone as defined by Caron (1985), i.e. early Cenomanian.

The presence of planktonic foraminifera suggests an infralittoral environment with noticable open sea connections.

***Whitinella baltica* Zone: (Late Cenomanian)**

The Zone is characterised the "G" Member of Abu Roash Formation with 750 feet thickness at Ghoroud well No. IX and 400 feet at Sharib IX. The presence of *Whitinella baltica* Douglas and Rankin suggests a late Cenomanian age as it appears only in the upper half of the *Rotalipora cushmani* Zone as defined by caron (1985), which is of late Cenomanian age.

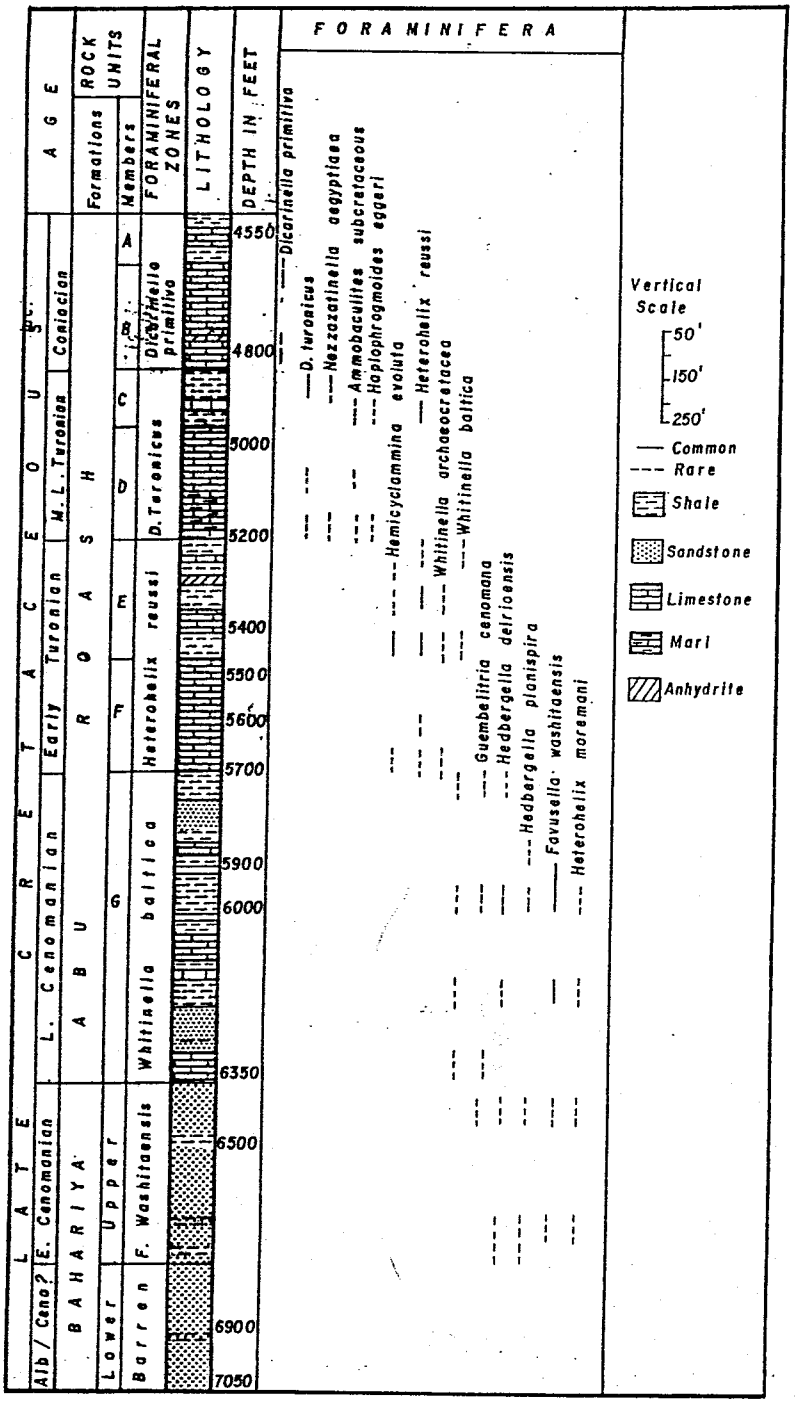


*Fig.(2) Stratigraphic range chart for Cenomanian / Turonian Foraminifera In Ghoroud well no.IX (Northern Western desert, Egypt).*

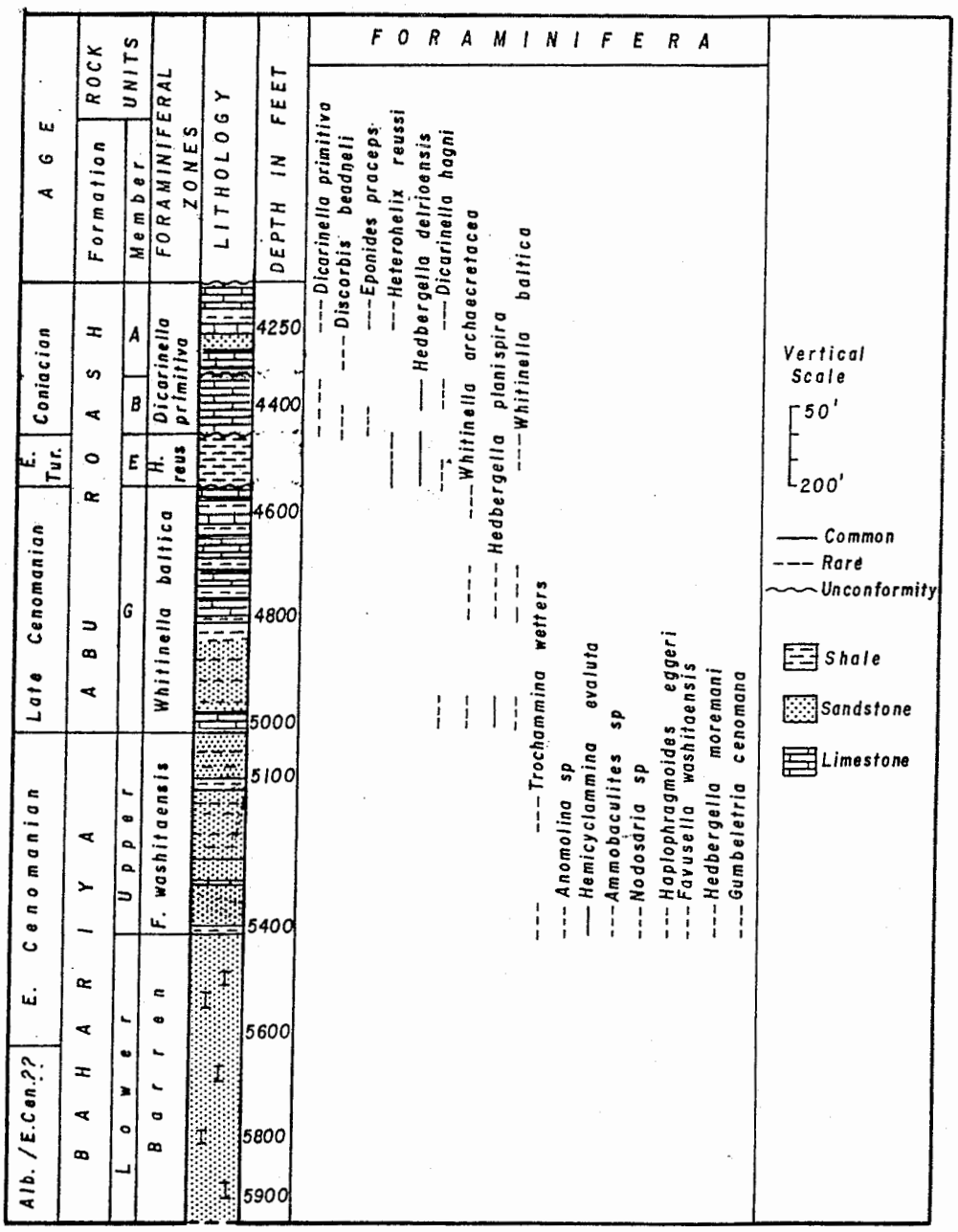


*Fig.(3) Stratigraphic range chart for Cenomanian / Turonian Foraminifera in Sharib well no. IX. ( Northern Western Desert, Egypt )*

***Heterohelix reussi* Zone: (early Turonian)**

At Ghoroud well No. IX the Zone is 500 feet thick and 100 feet thick at Sharib well No. IX. It is characterised by the following foraminifera: *Hemicyclammina evoluta* HAMOUI, *Ammobaculites subcretaceous*, CUSHMAN & Alexander,, *Eponides praeceps* BROTZEN, *Heterohelix reussi* CUSHMAN, *Whitinella archaeocretacea* and *Whitinella paradubia* SIGAL.

The presence of *Whitinella archaeocretacea* PESSAGNO and *Heterohelix reussi* CUSHMAN in the foraminiferal assemblage indicates early Turonian age (Caron, 1985).

***Discorbis turonicus* Zone**: (middle Turonian to late Turonian)

This Zone attains a thickness of 380 feet at Ghoroud well No. IX but absence at Sharib well No. IX, yeilding the following formainifera : *Discorbis turonicus* SAID & KENAWY, *Discorbis minutus* SAID & KENAWy, *Nezzazatinella aegyptiaca SAID and KENAWY*, *Ammobaculites subcretaceous* CUSHMAN, *Haplophragmoides rugosa* CUSHMAN, *Haplophragmoides eggeri* CUSHMAN and *Heterohelix reussi* CUSHMAN.

This is a widely distributed Turonian Zone in Egypt as the zonal species *Discorbis turonicus* SAID & KENAWY is considered to be restricted in Egypt to the Turonian and Coniacian (Andrawis 1976) and *Nezzazatinella aegyptiaca* SAID and KENAWY seems to restricted in Egypt to Turonian (Andrawis 1976).

***Dicarinella Primitiva* Zone: (Coniacian)**

This interval Zone was first defined by caron (1978) to represent the early Coniacian rocks, accordingly the two members "A" and "B" of Abu Roash Formation in the studied wells are belonging to the Coniacian age. The Zone occupies 320 feet thickness in Ghoroud IX and 300 feet thickness in Sharib IX. The following are the most diagnostic species for this Zone: *Dicarinella primitiva, Whitinella paradubia* SIGAL, *Archaeglobigerina cretacea, Dicarinella hagni, Hedbergella planispira* TAPPAN and *Hedbergella delrioensis* CARSEY.

## CONCLUSIONS:

According to the sedimentological criteria and foraminiferal contents, the Bahariya Formation has been deposited in a marginal marine domain under transgressive conditions.

The transgressive episodes are usually considered as periods of high erosion and little deposition. The erosive nature of transgression has led to subdued bar development and preservation of the deeply incised sandstone bodies (Such as tidal channels, flood tidal deltas).

Abu Roash Formation consists of clastics and carbonates reflecting alternating transgressive and regressive phases dominating through the time of deposition of late Cenomanian to (late Turonian- Coniacian) succession.

The stratigraphic column in the studied area is interrupted by several unconformities within the Upper Cretaceous, between the different members of the Abu Roash Formation) and between the jurassic (From lithologic log) and the Upper cretaceous in Sharib well No. IX.

The absence of C,D and F Members in Sharib well No. IX revealed that the area was topographically high with non deposition.

## ACKNOWLEDGEMENT:

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## EXPLANATION OF PLATES ALL FIGURES x 75

### PLATE I

Fig 1: Micrite, partly recrystallized, sample 5790', Sharib IX Bahariya Formation.

Fig 2 : Detrital quartz sand grains, set in a micritic cement, sample 5620', Sharib IX, Bahariya Formation.

Fig 3: Carbonate lithoclast, fractured, with a micritic internal texture (Lower part). Polycrystalline quartz grain with suture boundaries, between internal units (Upper part). Sample 5590', Sharib IX, Bahariya Formation.

Fig 4: Microcrystalline dolomite (Lower part). Detrital quartz sand grains, partly corrected in a dolomitic cement (upper part). sample 560', Sharib IX Bahariya Formation.

Fig 5: Sparry calcite (pseudospar) with a blocky texture, sample 5460', Sharib IX Bahariya Formation.

Fig 6: Poorly sorted quartz grains in a calcareous to argillaceous groundmass, sample 5470' Sharib IX Bahariya Formation.

**PLATE 2**

Fig 1: Laminated texture possibly produced by pressure solution, Sharib IX Bahariya Formation.

Fig 2: Dolomite with a minute fracture, sample 5370', Sharib IX, Bahariya Formation.

Fig 3: Biomicrite (mostly planktonic foraminifera and spicules) in a wackestone texture, sample 4670' Sharib IX, Abu-Roash Formation.

Fig 4: Partly dolomitized micrite, sample 4670', Sharib IX, Abu Roash Formation.

Fig 5: Biomicrite with a wackestone texture, sample 4670' Sharib IX Abu Roash Formation.

Fig 6: Variably recrystallized micrite, sample 4280', Sharib IX, Abu Roash Formation.

**PLATE 3**

Fig 1: Coated grains with recrystallized carbonate nuclei in a micritic (possibly dolomitized) ground-mass, sample 4410,' Sharib IX , Abu Roash Formation.

Fig 2: Forminifers, Echinoides fragments and micritic lithoclasts in a micritic groundmass, sample 4410' Sharib IX Abu Roash Formation.

Figs 3-6: Variably recrystallized micrite and biomicrite, sample 4390', Sharib IX, Abu Roash Formation.

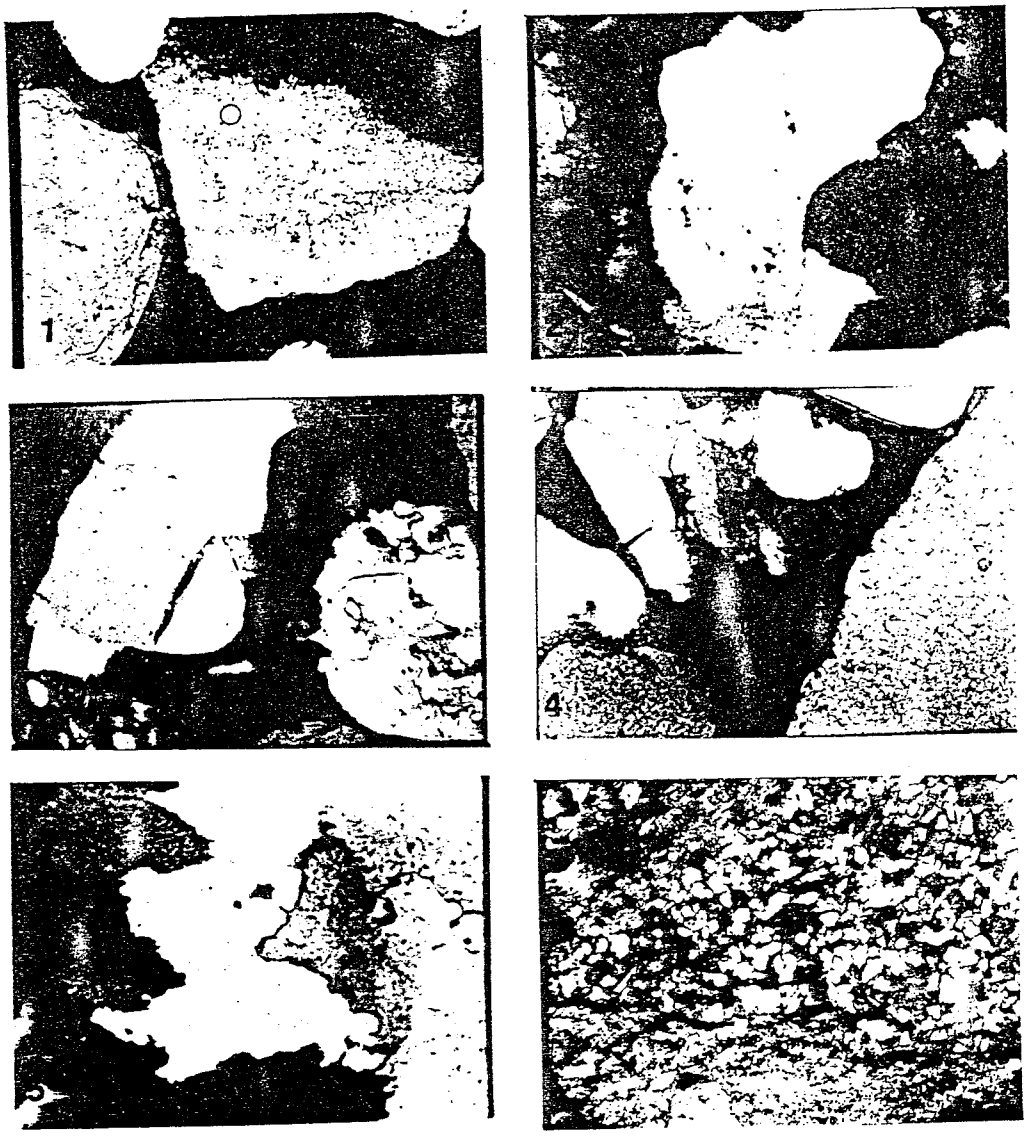


PLATE 1

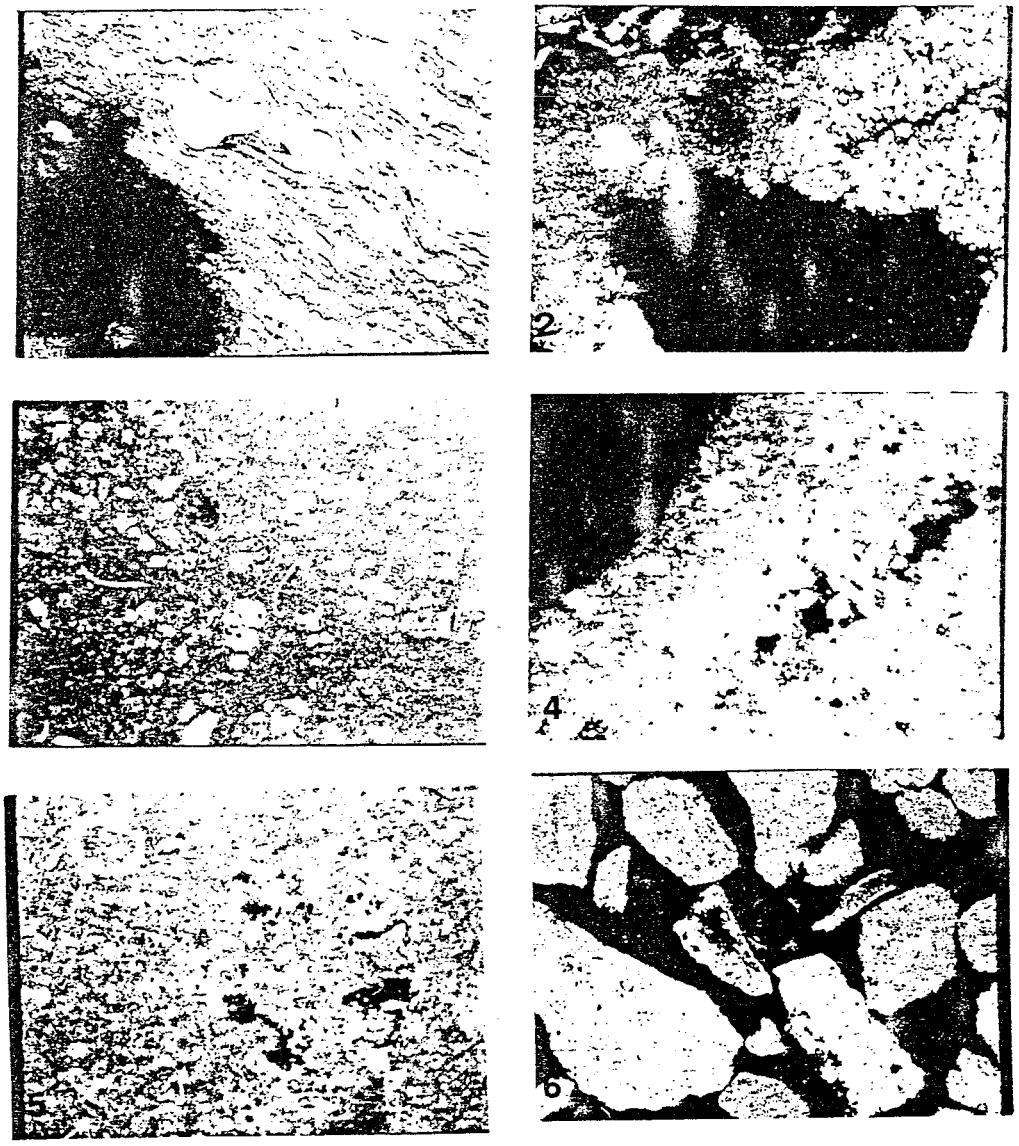


**PLATE 2**

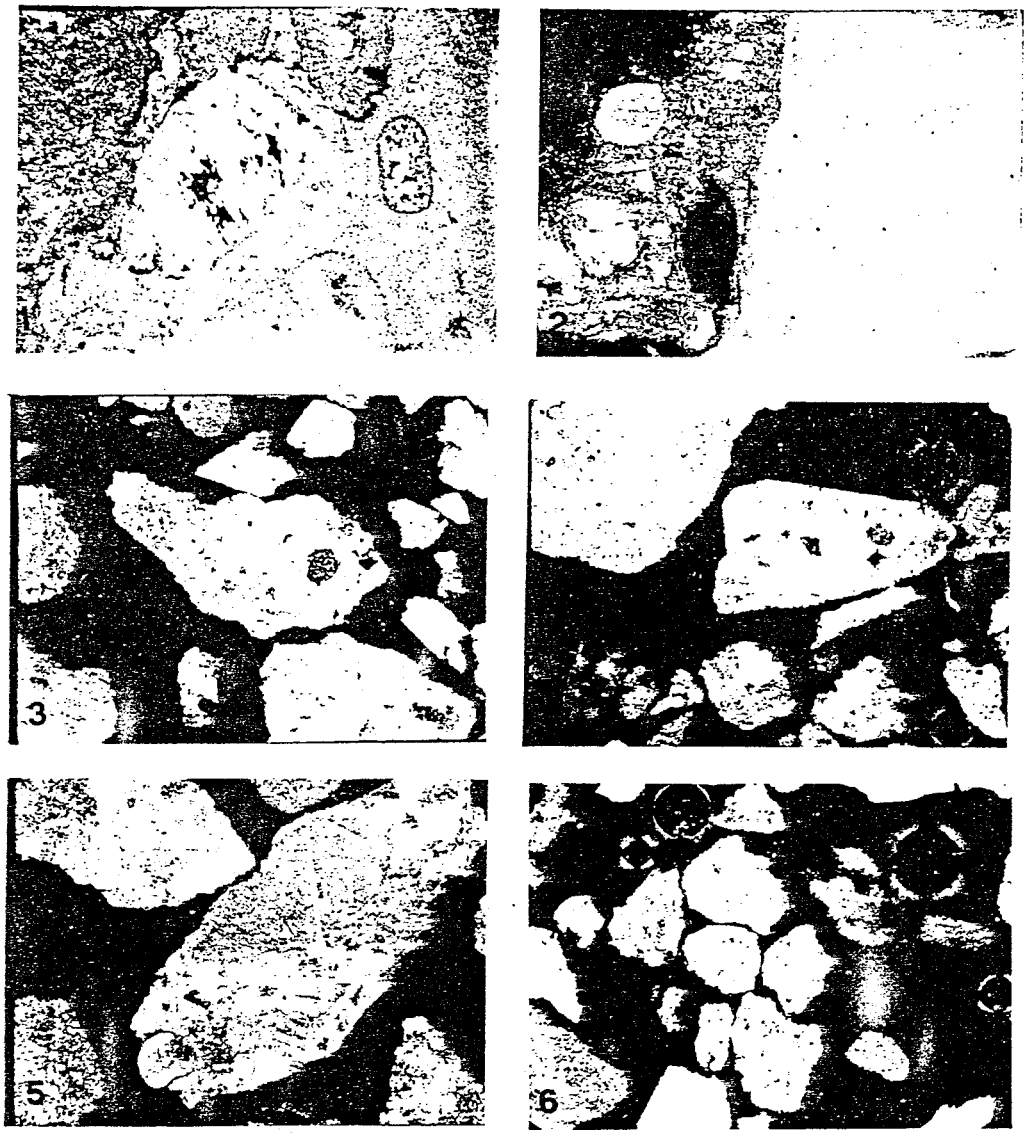


PLATE 3

# بيوستراتيجرافية الفورامينفرا والبيئات القديمة لصخور الكريتاوى العلوى (سينومانى - كونياسى) لبعض الآبار (بشمال غرب الصحراء الغربية)- مصر

**الدكتور/ حسن عبد المنعم أحمد الشيخ**

قسم الجيولوجيا- كلية العلوم-بنها

يشمل هذا البحث دراسة تفصيلية ليثوستراتيجرافية وبيوستراتيجرافية للواحدات الصخرية المختلفة الممثلة للعصور من السنيومانى حتى الكونياسى لتتابعات تحت سطحية للآبار (غرود، شارب) بشمال غرب الصحراء الغربية، باستخدام محتوى هذه التتابعات من الفورامنيفرا أمكن التعرف على أربع نطاقات حيوية للفورامينفرا الهائمة ونطاق حيوى واحد للفورامنيفرا القاعية وعلى أساسهم أمكن تحديد عمر الوحدات الطبقية التى تتكون منها التتابعات المذكورة لكل بئر.

ومن خلال دراسة السحن الدقيقة للوحدات الصخرية أمكن التوصل الى تقسيم التتابع المدروس فى هذه العصور الى مكون البحرية (وعمره سنيومانى مبكر) وينقسم الى عضو سفلى خالى من الفورامنيفرا وعضو علوى ويحتوى بعض الفورامنيفرا. وكذلك مكون أبو رواش والذى يشتمل على سبعة أعضاء (A-G) ويتراوح عمرها ما بين السينومانى المتأخر حتى الكونياسى المتأخر.

من خلال الدراسة السابقة امكن استنباط البيئات الترسيبية المختلفة حيث ترسب مكون البحرية عند مصاب الانهار بينما ترسب مكون أبو رواش فى بيئة بحرية عميقة حيث محتواها من الفورامنيفرا الهائمة.

لوحظ فى القطاعات المدروسة اسطح لعدم التوافق حيث اختفت بعض أعضاء مكون أبو رواش فى بئر شارب وكذلك وجود رواسب من عصر الكريتاوى العلوى مباشرة على صخور الجوراسى فى بئر شارب مما يدل على تعرض المنطقة لظروف تكتونية أدت الى هذا الانقطاع فى الترسيب.