IDENTIFICATION OF PALYNOZONES AND AGE EVALUATION OF ZUBAIR FORMATION, SOUTHERN IRAQ

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Abstract

Fourteen rock selected samples from lower and middle parts of Zubair Formation in Zubair 109 (Zb-109) and Zubair 43 (Zb-43) boreholes of Zubair oil field at southern Iraq, they have been subjected to standard palynological processing techniques were used to extract the acid resistant organic matter. Microscopic analysis of the sedimentary organic matter of the two boreholes revealed abundant and diverse palynomorphs of (35) species of spores belonging to (23) genera, (9) species of pollen grains belonging to (6) genera and (21) species of dinoflagellate cysts belonging to (13) genera.

Two assemblage palynozones have been also identified based on the index palynomorphs contained in each zone. The age assignment of each palynozone is based on international correlation with Australia, Middle East and Europe countries.

Introduction

Lower Cretaceous deposits are of great importance especially in middle and southern Iraq because they contain a great hydrocarbon accumulations and reserves, Zubair Formation is one of the formations that is represented by Late Berriasian-Albian cycle and it is an important formation because it is the main reservoir of oil and gas in fields of central and southern Iraq, the lithology of the formation in the studied area (Fig.1) is composed of interlocked sequences of sandstone, siltstone and mudstone/shale units which are alternating in some places of the formation, beneath and above this formation conformably and gradationally are Ratawi and Shuaiba Formations respectively in most cases. Formation thickness is 280 m-400 m at the type locality, this thickness is increasing towards the eastern north and decreasing towards west and western north[1-4].

The aim of this work is to diagnose the different species from organic palynomorphs and to determine palynozones of Zubair Formation Southern Iraq and their age, this study has been performed in details for spores, pollen grains and dinoflagellate cysts from samples that their depths mentioned in Figures 2 and 3 in boreholes Zb-109 and Zb-43 that were drilled by south oil company; these palynomorphs were employed for determining the stratigraphic unites in Zubair Formation that their boundaries represent a local and regional climatic and environmental variations which have been concluded from appearance of many palynomorphs and extinction of others in the palynozone boundary.

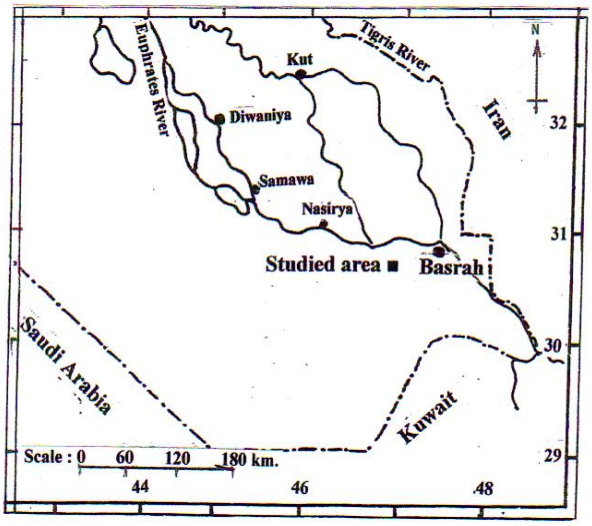


Fig.(1) : Map of part of southern Iraq and adjacent countries showing the location of the studied area on which this study is based.

Materials and Methods

Standard palynological processing techniques were used on all selected samples from (Zb-109) and (Zb-43) to extract sedimentary organic matters. These techniques were published in many researches[5-6]. Samples were crushed and sieved out by 0,5 mm sieve then treated with diluted HC1 followed by concentrated HC1 several times to get rid of calcium carbonate, thereafter treated with cold HF acid and repeat this process with heat to

get rid of silica. Organic materials of some samples were treated with HNO_3 to remove the outer coal seam of the sedimentary organic matters then the nylon mesh 0.02 mm is used for washing the organic materials clearly. Three slides for each sample were prepared and examined under microscope type Leitz Laborlux 1 1 pol to diagnose palynomorphs and to pick photos for the selected palynomorphs by using Olympus, BH-2 microscope and photograph system type Olympus, C-35 AD.

Results and Explanation

The palynomorphs distribution in Zb-109 and Zb-43 (Figs. 2 & 3) showed that the palynozones could be determined by the beginning of at least four indicated species of palynomorphs to define the lower boundary of the palynozone, and the upper boundary of the same palynozone is defined by appearance of four other new indicated species or more belonging to another palynozone above it or disappearance of species belonging to same palynozone; this type of determination is called assemblage zone[7]. Two palynomorphs have been selected in order to give a name of these palynozones; and the first letter of each species of that two palynomorphs was written.

For the purpose of age determination the palynomorphs recovered are considered to comprise a single assemblage because no significant differences in composition were recorded within the examined sections. Comparisons were done between occurrences of the taxa encountered and those recorded in the literature from widely scattered localities elsewhere so that the dating of the assemblage could be put in to a global perspective. The two determined palynozones via this work can be described as following:

1. Palynozone (PP):

Schizosporis parvus, Appendicisporites potomacensis:

This palynozone is determined by presence of spores, pollen grains and dinoflagellate cysts in the samples that their depths from 3419 m to 3382 m in borehole Zb-109 and in depths from 3472 m to depth 3436m in borehole Zb-43. This palynozone is characterized by appearance of the following spores and the spores that appeared in this zone and continued in the recent palynozone which is above it in the two boreholes, in addition to the spores that used in zone nomination:

Gleicheniidites senonicus, G. sp cf. *G. senonicus, Cyathidites minor, C. australis, Concavisporites obtusangulatus, Clavifera triplex, Circulina parva, Leptolepidites* sp of Thusu, *Concavissimisporites variverrucatus, Murospora florida, Sestrosporites pseudoalveolatus, Cicatricosisporites abacus, C.* sp of Ibrahim, *C.* sp cf. *C. abacus, C.* sp of Brideaux, *Dictyophyllidites harrisii, D. equiexinus, Trilobosporites invanova, Crybelosporites stylosus, Pilosisporites* sp of Ibrahim, *Reticulisporites vermiformis, Microfoveolatosporites canaliculatus.*

Also the following species from pollen grains appeared in this palynozone and some of them extended to the above zone in the two boreholes, in the addition to the pollen that used in zone nomination:

Triporoletes csnomanianus, Clavatipollenites sp cf. *C. hughesii, Ephedripites multicostatus, Cycadopites* sp 1, *Phimopollenites pannosus.*

The following are dinoflagllate cysts that present in this palynozone and some of them continued in the late zone:

Subtilisphaera perlucida, S. senegalensis, Circulodinium distinctum, C. sp cf. *inconspicum, Trichodinium intermedium, Oligosphaeridium pulcherrimum, O. complex, Cleistosphaeridium aciculare, Cribroperidinium* sp cf. *C. edwardsii, C.* sp 2, *Pareodinia* sp cf. *P. ceratophora, Heterosphaeridium* sp of Burger, *Pseudoceratium anaphrissum, Acanthaulax? Tenuiceras.*

2. Palynozone (BS):

Asbeckiasporites borysphenicus, Aequitriradites spinulosus:

This palynozone is determined by presence of different species of palynomorphs in the samples that their depths from 3382 m to 3305 m in borehole Zb-109 and in depths from 3436 m to 3362m in borehole Zb-43.

This palynozone is characterized by appearance of the following spores in addition to the two spores that used in zone nomination

and the spores that continued to appear from the palynozone (PP) that is below it:
Densoisporites microrugulatus,
Gleicheniidites sp, *G.* sp of Helby, *Coptospora williamsii, Circulina* sp, *Asbeckiasporites hoennensis, Cicatricosisporites hallei,*
Cyathidites sp, *Retitriletes circolumenus,*
Triletes sp cf. *T. tuberculiformis*

Also this palynozone is defined by presence of the following species of pollen grains and pollen that present in zone (PP) and continued appearing in this palynozone:

Clavatipollenites hughesii, *Cycadopites* sp 2., *Ephedripites* sp cf. *E. jansonii.*

This palynozone contains also the following dinoflagllate beside the species that appeared in the previous zone and continued in presence in this palynozone:
Spiniferites sp, *S. ramosus,*
Callaiosphaeridium asymmetricum,
Cribroperidinium orthoceras, C. sp 1, *C.* sp cf. *C. orthoceras, Gardodinium* sp.

Discussion and Conclusions

The stratigraphic comparison is carried out of the present palynozone (PP) in both boreholes from the similarity in the beginning of appearance of the following species from miospores and dinoflagllate cysts:
Dictyophyllidites equiexinus,
Appendicisporites potomacensis, Schizosporis parvus, Cycadopites sp 1, *Cribroperidinium* sp 2, *Pareodinia* sp cf. *P. ceratophora.*

The age of palynozone (PP) is determined by Late Hauterivian-Barremian depending on the ranges of index palynomorphs that present in the mentioned palynozone and compared with their same age equivalents in the following regions:

a. North of Sena (Egypt)
Pseudoceratium anaphrissum[8],
Dictyophyllidites equieximus[8],
Circulodinium sp cf. *C. inconspicum*[8].

b. West Desert (Egypt)
Subtilisphaera perlucida[9].

c. North East Libya
Pareodinia sp cf. *P. ceratophora*[10].

d. Germany
Subtilisphaera perlucida[11].

Also the stratigraphic comparison is done about the present palynozone (BS) in both boreholes from the similarity in the beginning of appearance of the following species from miospores and dinoflagllate cysts:
Aequitriradites spinnlosus,
Asbeckiasporites borysphenicus,
Gleicheniidites sp, *Cribroperidinium orthoceras, C.* sp 1, *Spiniferites* sp.

The age of palynozone (BS) is determined by Barremian-Aptian depending on the ranges of index palynomorphs that present in the mentioned palynozone and compared with their same age equivalents in the following regions:

a. Middle of Iraq
Callaiosphaeridium asymmetricum[12].

b. South of Iraq
Cribroperidinium orthoceras [13],
Subtilisphaera perlucida[13].

c. England
Clavatipollenites hugesii[14].

d. Australia
Cribroperidinium orthoceras [15],
Clavatipollenites hugesii [16],
Cyathidites australis [15].

e. Libya
Cribroperidinium orthoceras [10].

f. Mrocco
Cyathidites australis [17].

Plate - 1

1- *Cyathidites australis*, Couper, 1953.
borehole (Zb-43), depth 3436m, slide no. 8, mag.900x.

2- *Concavissimisporites variverrucatus,* Couper, 1963.
borehole (Zb-109), depth 3382m, slide no. 13, mag.700x.

3- *Cicatricosisporites hallei,* Delcourt and Sprumont, 1955.

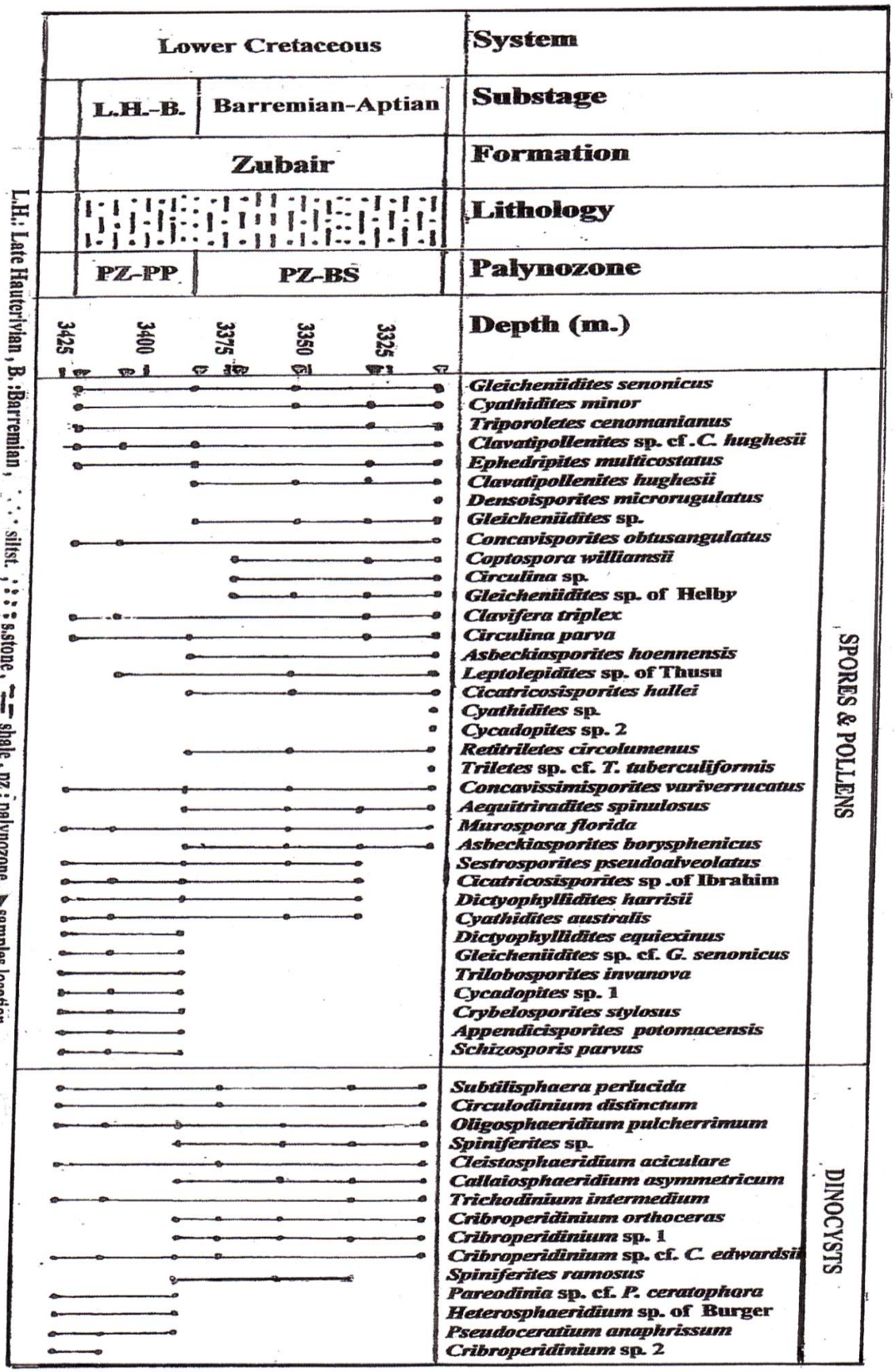


Figure 2. Stratigraphic ranges of characterizing species of spores, pollen grains and dinocysts in borehole (Zb-109).

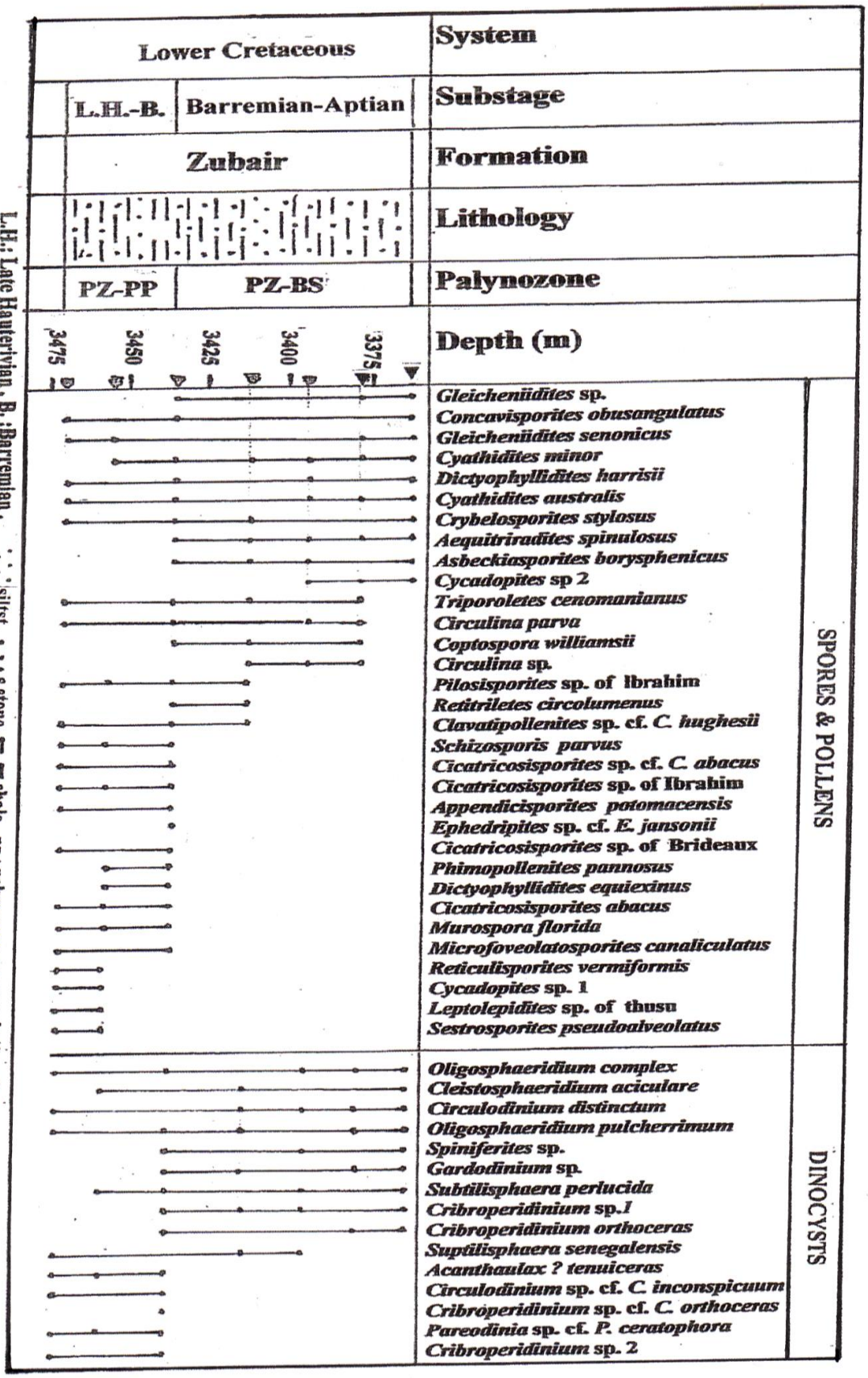


Figure 3. Stratigraphic ranges of characterizing species of spores, pollen grains and dinocysts in borehole (Zb-43).

borehole (Zb-109), depth 3352m, slide no. 23, mag.800x.

4- *Appendicisporites potomacensis,* Brenner, 1963.
borehole (Zb-109), depth 3382m, slide no. 17, mag.700x.

5- *Asbeckiasporites borysphenicus,* (Theodorova) Shakhmundes, 1976.
borehole (Zb-43), depth 3362m, slide no. 43, mag.800x.

6- *Circulina parva* Brenner, 1963.
borehole (Zb-43), depth 3394m, slide no. 33, mag. 800x.

7- *Densoisporites microrugulatus,* Brenner, 1963.
borehole (Zb-109), depth 3305m, slide no.9, mag. 700x.

8- *Coptospora williamsii,* Playford, 1971.
borehole (Zb-109), depth 3372m, slide no. 17, mag. 700x.

9- *Ephedripites multicostatus* Brenner, 1963.
borehole (Zb-109), depth 3330m, slide no. 33, mag. 800x.

10- *Phimopollenites pannosus,* (Dettmann&Playford) Dettmann, 1973.
borehole (Zb-43), depth 3436m, slide no. 43, mag.1400x.

11- *Cribroperidinium* sp 1.
borehole (Zb-109), depth 3372m, slide no. 27, mag.600

12- *Circulodinium distinctum* (Defland & Cookson 1955) Jansonius, 1986.
borehole (Zb-43), depth 3394m, slide no. 22, mag. 800x.

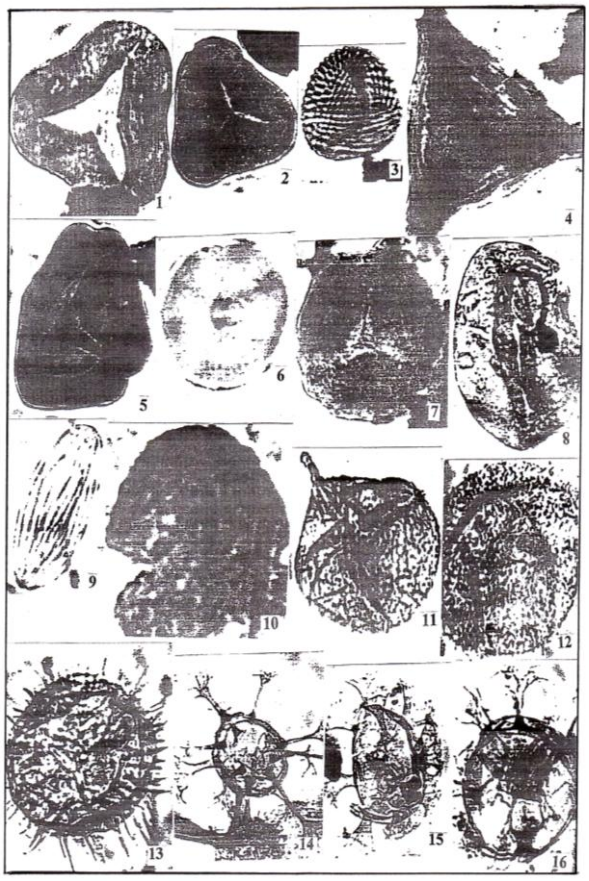
13- *Cleistosphaeridium aciculare,* Davey, 1969.
borehole (Zb-109), depth 3372m, slide no. 59, mag. 800x.

14- *Oligosphaeridium complex,* (White, 1842) Davey and Williams, 1966.
borehole (Zb-43), depth 3362m, slide no. 67, mag. 400x.

15- *Oligosphaeridium pulchrrimum,* (Deflandre&Cookson)Davey, 1966.
borehole (Zb-109), depth 3382m, slide no. 43, mag. 400x.

16- *Spiniferites* sp.
borehole (Zb-109), depth 3382m, slide no. 43, mag. 600x.

Plate - 1



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الخلاصة

اجريت التحليلات البالينولوجية لأربعة عشرة انموذجاً صخرياً من صخور الجزئين السفلي والوسطي لتكوين الزبير من البئرين زبير (109) وزبير(43) جنوبي العراق لأجل استخلاص المواد العضوية الرسوبية ثم فحصت الشرائح البالينولوجية المحضرة منها مجهرياً وميزت انواع مختلفة من الاشكال الحياتية العضوية فشخص (35) نوعاً من الابواغ تعود الى (23) جنساً و(9) انواع من حبوب اللقاح تعود الى (6) اجناس و (21) نوعاً من متكيسات ذوات السوطين تعود الى (13) جنساً.

تم تحديد نطاقين بالينولوجيين اعتماداً على ما يحتويه كل نطاق من انواع حياتية دالة ، كما حدد عمر كل نطاق من خلال مقارنة متحجراته العضوية الدقيقة بمكافئاتها بمقاطع مثبت فيها عمر الطبقات بدقة في مناطق مختلفة من العالم.