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Palynological Dating of the Quseir Formation, Kharga Oasis (Egypt)

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ABSTRACT. Previously reported fossil assemblages in the Quseir Formation do not contribute to definite age assessment. The formation was assigned a middle to late Campanian age according to its stratigraphic position below the well-dated (Campanian-Maastrichtian) Duwi (Phosphate) Formation No palynological work has previously been carried out on the Quseir Formation. Some arenaceous foraminifers (Campanian and Maastrichtian) were recorded from the Quseir Formation at Gebel Abu Had and Gebel Duwi (Eastern Desert). In the present study well-preserved palynomorphs have been recovered from shales equivalent to the Quseir Formation, in the Kharga subsurface section, Kharga Oasis. The presence of relatively large angiosperm pollen (e.g. *Tricolpites* spp., > 25 μm) co-occurring with rare *Dinogymnium dinocyst* species indicate a Campanion age for the Quseir Formation. Moreover, pre-Turonian pollen (*e.g. Classopollis* and *Eucommiidites*) are lacking. The nature and frequency of the recovered palynomorphs imply shallow water deposition. This is essentially inferred from the high percentages of land-derived miospores associated with the dominance of palynofacies debris, accompanied by low percentages of marine dinoflagellate cysts. From the data, the deposition of the Quseir Formation began shallower (in the topmost parts of the formation) and were deepening upwards as documented in the overlying Duwi Formation.

The Kharga Oasis in general forms a depression located about 200 km west of the Nile Valley between latitudes 24° and 26° north (Fig. 1). Unfossiliferous brown sandstones cover large tracts of the depression floor and are overlain by the Quseir Formation. The name "Quseir Formation" (Youssef 1957) was given to the

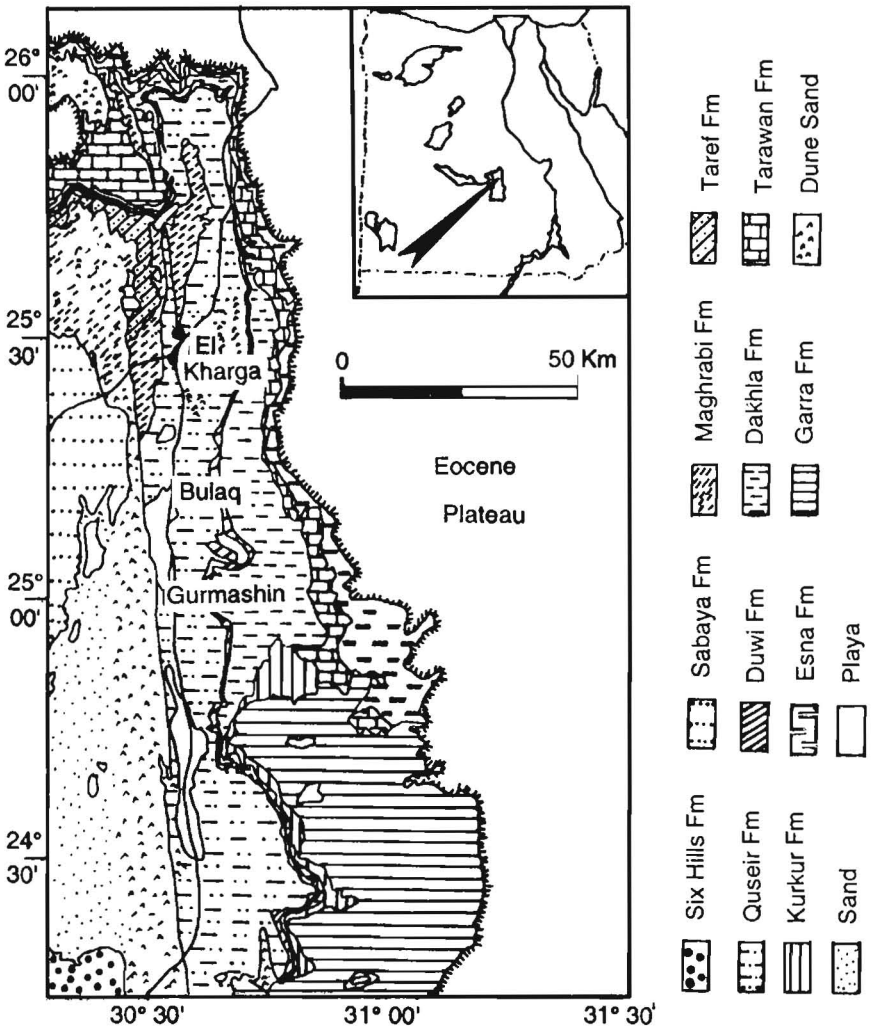


Fig. 1. Geological map of the Kharga area showing the location of the Kharga-22 well (compiled by Hermina 1990 from various authors).

varicoloured shales overlying the "Nubia" sandstone rocks exposed at many parts of the country.

Hermina (1990) stated that the faunal assemblages in the Quseir Formation do not provide a definite age. However a middle to late Campanian (Late Cretaceous) age was assumed for the formation in the Kharga area, where it is succeeded by the

reliably dated Duwi Formation (Campanian or ? Campanian-Maastrichtian). So far, no palynological work dealing with the Quseir rocks has previously been performed. Kenawy *et al.* (1976) recovered some agglutinated foraminifers from the Quseir Formation exposed at Gebel Abu Had and Gebel Duwi, Eastern Desert, and assigned the formation a Campanian and Maastrichtian age. In the present study an interval of the Quseir Formation in the subsurface section of the Kharga area (Kharga-22 borehole, depths from 14 m to 96 m. Table 1) has yielded well preserved palynomorphs, allowing a good age assessment. The identified palynomorphs and their distribution in the productive samples are tabulated in Table 3.

Materials and Methods

This study is based on ditch samples collected from the Kharga-22 water well. Each interval of the studied borehole is represented by a certain number of samples constituting a "sample group". Samples were subjected to routine palynological preparations, *i.e.* to HCl and HF acid treatments and to sieving through a 10 µm mesh. Three intervals proved rich in palynomorphs (Table 1). Palynological slides and residues produced for the study are stored in the collections of the Geological Museum of the Geology Department, Assiut University, Egypt.

Table 1. Analysed samples, depths in meters below surface and lithological descriptions of the Kharga-22, Kharga Oasis.

Sample Group No.	Depth (M) Below Surface	Positive Samples ***	Lithological Description
1	14-16	***	Grey to slightly reddish grey shale
2	16-18	***	
3	22-24		
4	24-28		
5	28-32		Brownish grey to brownish yellow siltstone
6	32-36		
7	46-50		
8	50-58	***	Grey shale
9	64-68		Violet siltstone
10	68-72		Violet shale
11	72-76		
12	78-82		Violet to violet grey shale
13	90-94		
14	94-96		

Age Assessment

Taylor (1981) stated that the first distinct tricoplate pollen appear at about the middle of the Albian stage. They are small (less than 25 μm in diameter) and are attributed to the genera *Tricolpites* and *Tricolpopollenites.* He noted that there was a rapid evolution of size, shape and exine structure on such tricolpates from the Albian into younger strata. Therefore the present angiosperms (with diameter mostly > 25 μm) point, in general, to a Late Cretaceous age. *Fraxinoipollenites variabilis* Stanley and *Tricolpites vulgaris* (Pierce) Srivastava were depicted by Schrank (1987) from the Maastrichtian rocks of the Younis North well, Egypt. He added that *T. vulgaris* is recorded in allegedly Albain strata of the Aswan region (Abdel Mohsen 1986) which should be interpreted as Coniacian. Schrank also stated that assemblages with *Foveotricolpites giganteus* (Jardiné and Magloire) Jan Du Chêne *et al* and *F. tienabaensis* (Jardiné and Magloire) Schrank indicate an Early Senonian age for the upper Wadi Howar or the lower Kababisch Formation (Sudan).

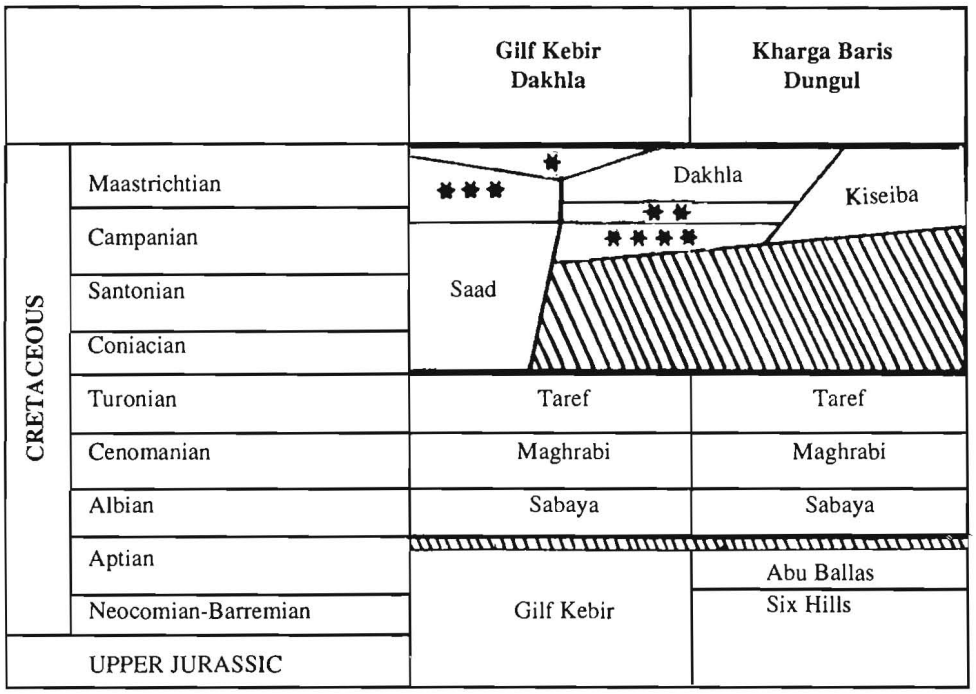
Dinogymnium undulosum was recorded from the lower part of Duwi Formation (Campanian) in the Abu Tartur mine (Schrank 1987). Other *Dinogymnium* species (*e.g. D. acuminatum* Evitt, Clarke and Verdier and *D. westralium* (Cookson and Eisenack) Evitt, Clarke and Verdier were reported from Campanian-Maastrichtian rocks of Egypt. *Dinogymnium acuminatum is* known from the Campanian-Maastrichtian of Gabon (*e.g.* Boltenhagen 1977) and of Morocco (Rauscher and Doubinger 1982). In spite of the rare *Dinogymnium* which is badly preserved herein, the age of the productive interval is post-Turonian. *Classopollis* Maljavkina and *Eucommiidites* Erdtman pollen, for example, are absent from post-Turonian assemblage (*e.g.* Srivastava 1978). In the meridional Kharga-Baris-Dungul belt, extending in a north-south direction, a considerable Coniacian-Santonian hiatus occurs (Hermina *et al.* 1989, see Table 2). Consequently a Campanian age should be assigned to the studied interval.

Discussion and Conclusions

The palynological association recovered from the the Kharga-22 well has allowed the recognition of a Campanian age corresponding to the productive interval of the well. Although much of the identified microfossils are known from Middle Cretaceous rocks of Egypt (*e.g.* Schrank 1987, Leereveld *et al.* 1990, Mahmoud 1993) this age assignment is based on the presence of the larger tricolpate pollen and the dinocyst *Dinogymnium* species although rare and badly preserved.

Abdel Mohsen (1992) recognized three palynological assemblage zones from the subsurface Nubia rocks in the Kharga Oasis. He assigned a Campanian-

Table 2. Correlation of rock units (formations) in the New Valley area (after Hermina *et al.* 1989).



Maastrichtian age for his uppermost zone (in the Jovrein-17 well, several kilometers southwest of the Kharga-22 well). The general geology of the area points to the absence of Maastrichtian sediments (equivalent to the lower part of the Dakhla Formation) as seen in Fig. 1. Therefore, a Campanian age should be assigned for the uppermost zone of Abdel Mohsen (1992).

The Kharga 1 well (west of Kharga-22) was investigated palynologically by Saad and Ghazaly (1976) and Kedves (1986). As Schrank (1992) remarked, the presence of triangular triporate pollen grains (*Proteacidites* type A of Saad and Ghazaly 1976) at 12 m and 28 m in Kharga-1 indicates a late Cenomanian age, corresponding to the "Maghrabi Formation". This view is substantiated, in the light of the present data, *i.e.* by the absence of any representatives of *Dinogymnium.* in the Kharga assemblages. On the other hand, the surface geology where the Kharga 1 well is located shows outcrops of the Cenomanian Maghrabi Formation (see Fig. 1).

Table 3. Alphabetical listing of the identified palynomorphs and their distribution (presence/absence) in the Kharga-22 well.

8	2	1	Sample Group No. / Palynomorph Taxa
		*	*Apteodinium* spp.
*	*	*	*Araucariacites / Inaperturopollenites* Group
	*	*	*Callialasporites* spp.
	*		*Cicatricosisporites* sp.
	*	*	*Concavissimisporites* spp.
*	*		*Crybelosporites* spp.
	*		*Cycadopites* spp.
*	*	*	*Deltoidospora* spp.
		*	*Dinogymnium* spp.
	*		*Dinogymnium undulosum* Cookson and Eisenack
	*		*Escharisphaeridia* spp.
*			*Foveotricolpites gigantoreticulatus* (Jardiné and Magloire)
		*	*Fraxinoipollenites variabilis* Stanley
	*	*	*Granulatisporites* spp.
*			*Kuylisporites lunaris* Cookson and Dettmann
		*	*Matthesisporites* spp.
*			*Multicellaesporites* spp.
	*	?	*Systematophora* spp.
	*		*Taurocusporites* spp.
		*	*Todisporites minor* Couper
*	*	*	*Tricolpites* spp. > 25 µm
		*	*Tricolpites* spp. < 25 µm
*			*Tricolpites vulgaris* (Pierce)
*		*	*Triplanosporites* spp.
*			*Unicellaesporites* spp.
*		*	*Verrucosisporites* spp.

Considering the data given in Fig. 2, the present palynomorphs are thought to have been deposited close to the palaeoshoreline (shallow shelf). This is inferred from the high percentage frequencies of the land-derived miospores (up to 90.2% from the total number of palynomorphs) and the relatively low percentages of dinocysts (maximum value 16.5%) in addition to the dominance of debris of plant tissues forming opaque and amorphous materials. From surface exposures of the Abu Tartur area, several kilometers west of Kharga, Omran and Mahmoud (1993) recorded a Campanian "Microfloral Assemblage I" in dark grey shales overlying the phosphate bed of economic importance in the Duwi Formation (overlying the Quseir Formation), which yields a rich angiosperm association (up to 67%), as dominating land-derived elements. This figure contrasts with the present association, where the spores are the dominating land-derived elements (> 70 %, Fig. 2). This would suggest that the environmental setting changed from shallower (Quseir Formation, the upper varicoloured, mottled, silty and sandy shales of the formation) to deeper facies in a deepening-upward cycle (cf. Awad and Ghobrial 1965, Hendriks *et al.* 1984, Hremina 1990).

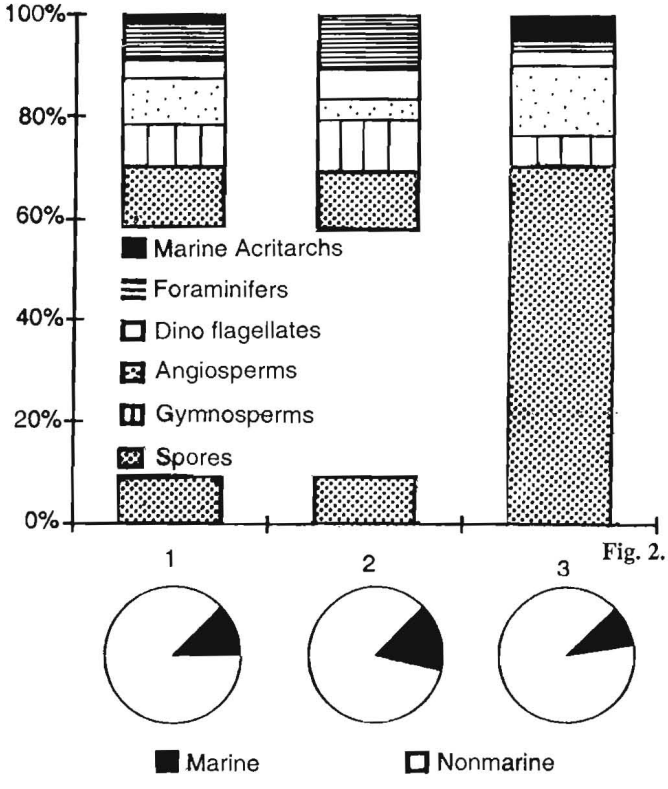


Fig. 2. Relative percentage frequencies and marine/nonmarine ratios of different palynomorph categories in each sample group.

Acknowledgement

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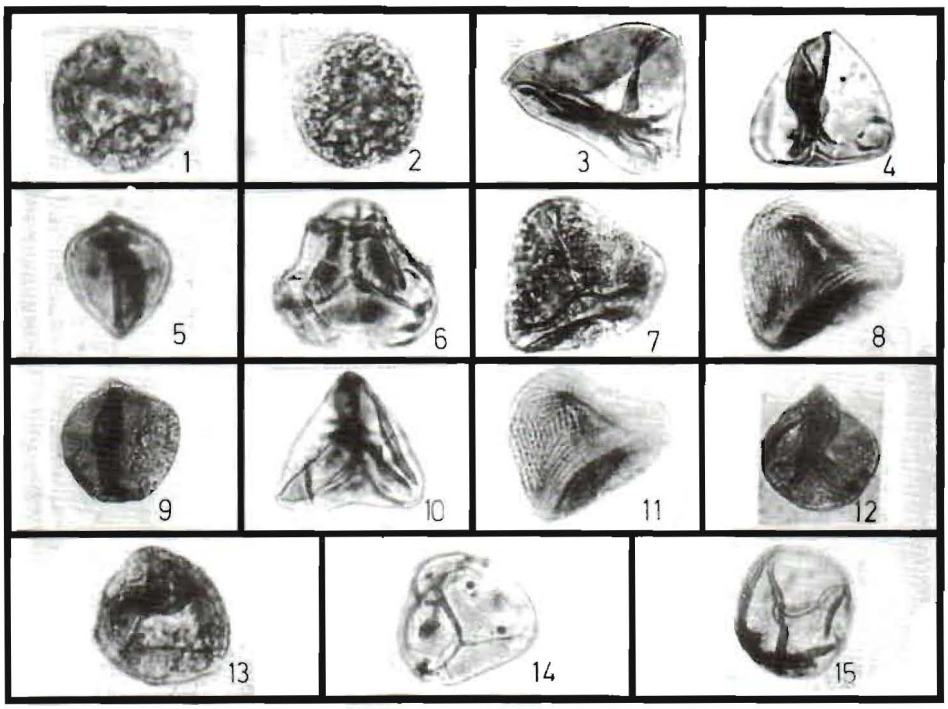

Plate 1. (indices are taken with a Carl-Ziess (Jena) transmitted-light microscope (Laboval-4).

1,2- *Verrucosisporites* spp.
1- slide 8C, 113.9/19.5, diameter 54 µm.
2- slide 8C, 115.3/16.8, diameter 40.5 µm.
3,4,10,14- *Deltoidospora* spp.
3- slide 2A, 101.1/9.5, diameter 60 µm.
4- slide 1C, 101.8/17.6, diameter 55 µm.
10- slide 1A, 107.0/5.7, diameter 43.5 µm.
14- slide 1A, 98.9/5.6, diameter 50 µm.
5- *Triplanosporites* sp., slide 1A, 107.4/25.5, diameter 50 µm.
6- *Kulylisporites lunaris,* slide 8E, 114.8/8.9, diameter 24 µm.
7,9,12- *Granulatisporites* spp.
7- slide 2B, 100.7/10.2, diameter 64 µm.
9- slide 2F, 111.9/10.1, diameter 70 µm.
12- slide 1A, 97.2/25.6., diameter 52 µm.
8,11- *Cicatricosisporites* sp. [cf. *C. australiensis* (Cookson) Potonié],
slide 2B, 97.1/15.6, diameter 63 µm.
8- proximal view, 11-distal view.
13- Unidentified spore, slide 8F, 103.6/19.1, diameter 39 µm.
15- *Todisporites* minor, slide 1C, 108.3/17.2, diameter 69 µm.

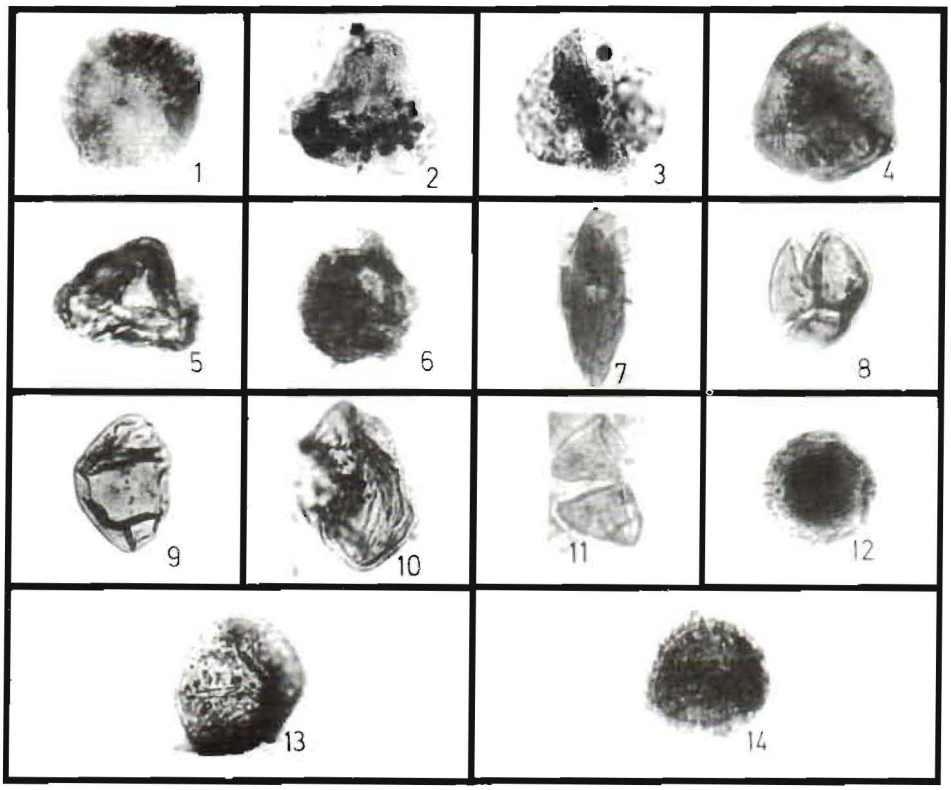

Plate 2

1- *Callialasporites* sp., slide 1C, 107.9/14.8, diameter 45 μm.
2,3- *Granulatisporites* spp.
2- slide 1A, 90.0/21.2, diameter 55 μm.
3- slide 1C, 114.0/14.2, diameter 51.5 μm.
4,5- Unidentified spores
4- slide 8T, 95.6/14.5, diameter 56 μm.
5- slide 8G, 111.5/8.0, diameter 41 μm.
6,14- *Crybelosporites* spp.
6- slide 8H, 117.6/25.7, diameter (including cavation) 55 μm
14- slide 8F, 103.6/18.9, diameter 50 μm.
7- *Cycadopites* sp., slide 2D, 118.0/5.8, length 120 μm.
8- Unidentified miospore, slide 1A, 98.2/16.3, diameter 81 μm.
9- *Araucariacites* sp., slide 1B, 115.5/17.8, diameter 112 μm.
10- *? Dinogymnium* sp., slide 1A, 91.0/21.1, length 45 μm.
11- Broken specimen of *Tricolpites vulgaris,* slide 8C, 112.1/17.3, diameter 50 m.
12- *Taurocusporites* sp., slide 2C, 112.1/17.3, diameter 50 μm.
13- *Matthesisporites* sp., slide 1A, 101.0/27.8, diameter 38 μm.

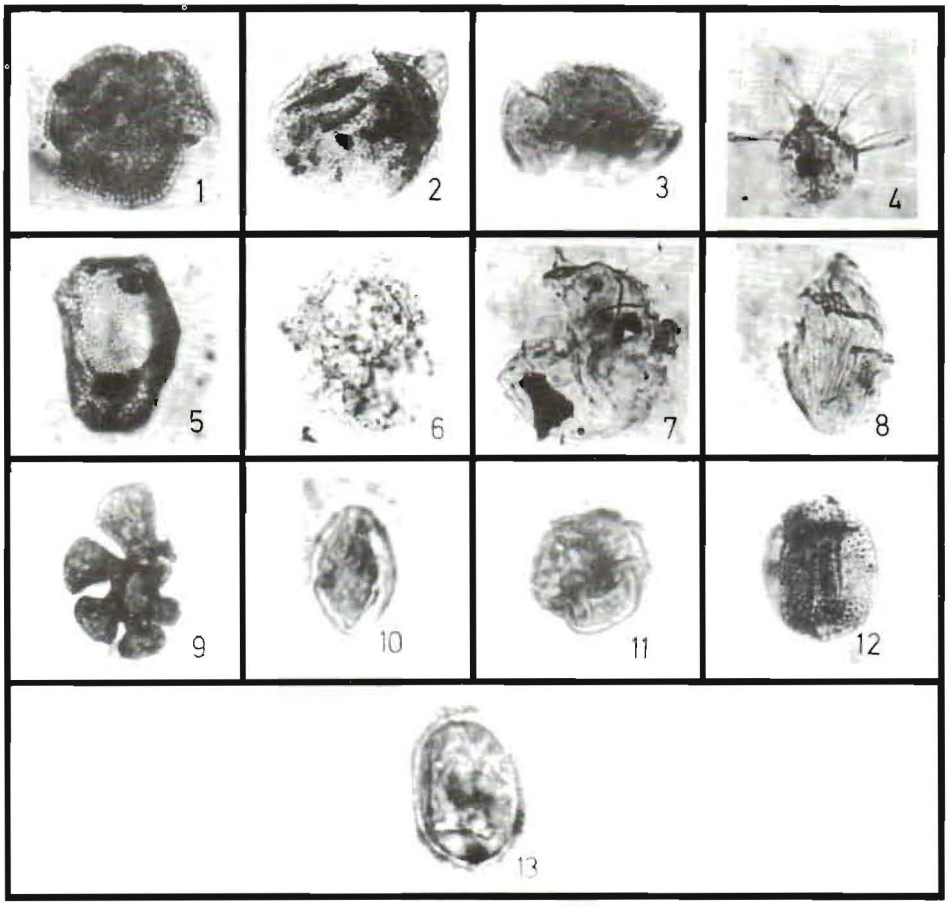

Plate 3

1- *Foveotricolpites gigantoreticulatus,* slide 8B, 102.5/25.0, diameter 54 µm.
2- Unidentified proximate dinoflagellate cyst, slide 2B, 115.3/10.0, diameter 70 µm.
3- *Tricolpites* sp., slide 2A, 101.2/9.3, diameter 56 µm.
4- Marine acritarch, slide 1A, 103.5/7.4, diameter 33 µm.
5- Unidentified pollen, slide 1C, 108.6/14.2, length 103 µm.
6- Badly preserved dinocyst (aff. *Systematophora*), slide 2B, 102.2/4.2, body diameter 72 µm.
7- *Apteodinium* sp., slide 1A, 115.8/11.2, length 53 µm.
8- *Ephedripites* sp., slide 2A, 110.4/6.0, length 55 µm.
9- Foraminiferal test lining, slide 1A, 113.5/12.9.
10- *? Tricolpites* sp., slide 1A, 90.7/15.9, length 17 µm.
11- *Tricolpites* sp., slide 8C, 105.4/20.2, diameter 23 µm.
12- *Fraxinoipollenites variabilis,* slide 1A, 100.5/11.1, diameter 38 µm.
13- Unidentified pollen, slide 2C, 119.3/18.2, diameter 30 µm.

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أهمية ودور الأحافير النباتية في تأريخ رواسب متكون القصير بالواحات الخارجة لجمهورية مصر العربية

مجدي صلاح محمود

قسم الجيولوجيا - كلية العلوم - جامعة أسيوط - أسيوط ٧١٥١٦ - مصر

تعتبر طفال متكون القصير بمصر من الرسوبيات الفقيرة أو النادرة في محتواها الأحفوري ، ولذلك فان معظم المحاولات التي أجريت لتقدير العمر النسبي لهذه الصخور تعتمد أساساً على معرفة ما فوقها من صخور معلومة العمر النسبي . فنجد أن متكون الضوي الذي يعلو مباشرة متكون القصير قيد البحث ينتمي إلى العمر الكمباني (إلى ماسترختي بأعلاه) ولذلك فان عمر ما تحته بالضرورة كمباني إلى ما قبل كمباني ، وقد أوضحت الدراسة الحالية فعلاً أن متكون القصير هذا بمنطقة الخارجة ينتمي إلى العمر الكمباني وذلك أيضاً يتفق مع المشاهدات الجيولوجية المسجلة . وقد أوضح التواجد المعاصر للأنواع كبيرة الحجم من مغطاة البذور ثلاثية الشق مع الأنواع المشار إليها بالمتن من السوطيات الدوارة أن عمر الطفال المتعددة الألوان والمعروف عنها تبعيتها لمتكون القصير ببئر الخارجة-٢٢هو العمر الكمباني . وقد أوضح وجود العناصر البحرية مع العناصر القارية من الأبواغ وحبوب اللقاح أن الصخور المدروسة قد ترسبت في بيئة بحرية ضحلة حيث يؤكد ذلك وفرة الأحافير النباتية القارية (أكثر من ٧٠ بالمائة من الصحبة ككل) مع البقايا النباتية من

أنسجة مختلفة وغيرها من البقايا العضوية ، وذلك يؤكد أيضاً بداية التقدم البحري وتزايد أعماق الترسيب لأعلى أثناء ترسيب متكونات الضوى والداخلة المعروفين .