

1-Jurassic-Cretaceous palynomorphs, palynofacies, and petroleum potential of the Sharib-1X and Ghoroud-1X wells, north Western Desert, Egypt

Zobaa, MK (Zobaa, Mohamed K.);
Benha Univ, Fac Sci, Dept Geol, Banha 13518, Egypt
mohamed.zobaa@fsc.bu.edu.eg

El Beialy, SY (El Beialy, Salah Y.);
Mansoura Univ, Fac Sci, Dept Geol, Mansoura 35516, Egypt

El-Sheikh, HA (El-Sheikh, Hassan A.);
Benha Univ, Fac Sci, Dept Geol, Banha 13518, Egypt

El Beshtawy, MK (El Beshtawy, Mohamed K.)
Benha Univ, Fac Sci, Dept Geol, Banha 13518, Egypt

Abstract:

Palynomorph and palynofacies analyses have been performed on 93 cutting samples from the Jurassic Masajid Formation and Cretaceous Alam El Bueib, Alamein, Dahab, Kharita, and Bahariya formations in the Sharib-1X and Ghoroud-1X wells, north Western Desert, Egypt. Two palynological biozones are proposed for the studied interval of the Sharib-1X well: the Systematophora penicillata-Escharisphaeridia pocockii Assemblage Zone (Middle to Late Jurassic) and the Cretacaeiporites densimurus-Elateroplicites africaensis-Reyrea polymorpha Assemblage Zone (mid-Cretaceous: late Albian to early Cenomanian). Spore coloration and visual kerogen analysis are used to assess the thermal maturation and source rock potential. Mature oil prone to overmature gas prone source rocks occur in the studied interval of the Sharib-1X well, whereas highly mature to overmature gas prone source rocks occur in the studied interval of the Ghoroud-1X well.

Palynofacies and palynomorph assemblages in both wells reflect shallow marine conditions throughout the Jurassic and the late Albian and early Cenomanian. During these times, warm and dry climatic conditions prevailed. The Cretaceous palynomorph assemblages of the Sharib-1X well correlate with the Albian-Cenomanian Elaterates Province of Herngreen et al. (1996). (c) 2012 Elsevier Ltd. All rights reserved.

Author Keywords: Jurassic; Cretaceous; Palynomorphs; Palynofacies; Thermal maturation; Petroleum potential

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Reprint Address: Zobaa, MK (reprint author), Benha Univ, Fac Sci, Dept Geol, Banha 13518, Egypt.

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2-Lower and Middle Miocene biostratigraphy, Gulf of Suez, Egypt based on dinoflagellate cysts and calcareous nannofossils

Piller, WE (Piller, Werner E);
Graz Univ, Inst Earth Sci Geol & Palaeontol, A-8010 Graz, Austria

Soliman, A (Soliman, Ali);
Tanta Univ, Fac Sci, Dept Geol, Tanta 31527, Egypt
ali.soliman@uni-graz.at

Coric, S (Coric, Stjepan);
Brock Univ, Dept Earth Sci, St Catharines, ON L2S 3A1, Canada

Head, MJ (Head, Martin J.);
Brock Univ, Dept Earth Sci, St Catharines, ON L2S 3A1, Canada

El Beialy, SY (El Beialy, Salah Y.)
Mansoura Univ, Fac Sci, Dept Geol, Mansoura 35516, Egypt

Abstract

This is the first detailed stratigraphic correlation of Lower and Middle Miocene deposits in the Gulf of Suez, Egypt using dinoflagellate cysts. The correlation is based on 273 ditch-cutting samples from five onshore boreholes located along the southwestern margin of the Gulf of Suez. The interval studied is represented by the Nukhul, Rudeis and Kareem formations of the Gharandal Group, and the lower part of the Belayim Formation of the Ras Malaab Group. These Miocene deposits unconformably overlie the Lower or lower Middle Eocene. The dinoflagellate cyst record is more diverse than previously reported and many taxa are documented for the first time in Egypt. Five biozones are established and tied to a chronostratigraphic framework by calibration to calcareous nannofossils (NN biozones) obtained from the same set of samples: (1) *Lingulodinium machaerophorum* Assemblage Biozone (GOS1), Aquitanian through mid-Burdigalian; (2) *Exochosphaeridium insigne* Taxon-range Biozone (GOS2), lower through mid-Burdigalian; (3) *Apteodinium spiridoides* Interval Biozone (GOS3), mid-Burdigalian through lower Langhian; (4) *Cleistosphaeridium placacanthum* Interval Biozone (GOS4), upper Burdigalian, Langhian, and lower Serravallian?; and (5) *Polysphaeridium zoharyi* Assemblage Biozone (GOS5), upper Langhian and Serravallian?

Comparison with other Miocene biozonations from the Mediterranean, Central Paratethys, North Atlantic region, and eastern USA indicate that the highest occurrences of *Apteodinium spiridoides*, *Cordosphaeridium cantharellus*, *Distatodinium paradoxum*, *Exochosphaeridium insigne* and *Cleistosphaeridium placacanthum*, and the lowest occurrences of *Exochosphaeridium insigne* and *Sumatradinium soucouyantiae* are important datums, whereas the lowest occurrences of *Hystriochosphaeropsis obscura*, *Labyrinthodinium truncatum*, and *Operculodinium? borgerholtense* provide useful supporting age control.

KeyWords Plus: DINOCYST STRATIGRAPHY; DEPOSITIONAL HISTORY; OLIGOCENE; BOREHOLE; BASIN; RIFT; PALEOENVIRONMENTS; CHRONOLOGY; ZONATION; EVENTS

Reprint Address: Soliman, A (reprint author), Graz Univ, Inst Earth Sci Geol & Palaeontol, Heinrichstr 26, A-8010 Graz, Austria.

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3- PALYNOLOGY OF THE MID-CRETACEOUS MALHA AND GALALA FORMATIONS, GEBEL EL MINSHERA, NORTH SINAI, EGYPT

El Beialy, SY (El Beialy, Salah Y.);

Mansoura Univ, Fac Sci, Dept Geol, Mansoura 35516, Egypt

Head, MJ (Head, Martin J.)^[2];

Brock Univ, Dept Earth Sci, St Catharines, ON L2S 3A1, Canada

El Atfy, HS (El Atfy, Haytham S.)

Mansoura Univ, Fac Sci, Dept Geol, Mansoura 35516, Egypt

Abstract

Palynological investigations of the mid-Cretaceous, delta-influenced Malha Formation and superjacent transgressive Galala Formation exposed at Gebel El Minshera, north Sinai, Egypt, have yielded a sparse but biostratigraphically useful record of spores, pollen, and rare dinoflagellate cysts. A representative of the pollen genus *Tricolporites*, recovered 18 m above the base of the Malha Formation, is post-Aptian in age. An interval comprising the upper Malha Formation and lower Galala Formation is dated as middle Albian/middle Cenomanian based on the occurrence of *Elaterosporites klaszii* at the base and *Afropollis jardinus* at the top. A palynoflora from the upper Malha Formation, which includes ephedroids as well as *Elaterosporites*, has affinities with the Albian-Cenomanian Elaterates Province. The presence of palynomorphs associated with active fluvio-deltaic settings supports a proximal deltaic environment for the deposition of the Malha Formation, with the superjacent Galala Formation representing a subsequent marine flooding of the delta. A distinctive monospecific assemblage of the dinoflagellate cyst *Subtilisphaera senegalensis* in the upper part (Cenomanian) of the Galala Formation reflects an ecologically stressed, marginal-marine environment. This assemblage constitutes the first record of the mid-Cretaceous *Subtilisphaera* ecozone in Egypt and indeed east of Morocco, and in deposits as young as Cenomanian. The Malha and lowermost Galala Formations are characterized by type III-VI kerogen, which is gas prone but having little potential to produce hydrocarbons. Spore-pollen color indicates thermal maturity at the transitional to over-mature level, which is anomalously high when compared with equivalent deposits in the region.

KeyWords Plus: ELATER-BEARING POLLEN; WESTERN-DESERT; ORGANIC FACIES; PALYNOSTRATIGRAPHY; PALYNOFACIES; PALYNOMORPHS; WELL; SEDIMENTS; BRAZIL; BASIN

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4- PALYNOLOGY OF THE MID-CRETACEOUS MALHA AND GALALA FORMATIONS, GEBEL EL MINSHERA, NORTH SINAI, EGYPT

[El Beialy, SY](#) (El Beialy, Salah Y.);

Mansoura Univ, Fac Sci, Dept Geol, Mansoura 35516, Dakahlia, Egypt
syelbeialy@mans.edu.eg

[El Atfy, HS](#) (El Atfy, Haytham S.);

Mansoura Univ, Fac Sci, Dept Geol, Mansoura 35516, Dakahlia, Egypt

[Zavada, MS](#) (Zavada, Michael S);

E Tennessee State Univ, Dept Biol Sci, Johnson City, TN 37614 USA

[El Khoriby, EM](#) (El Khoriby, Essam M.);

Mansoura Univ, Fac Sci, Dept Geol, Mansoura 35516, Dakahlia, Egypt

[Abu-Zied, RH](#) (Abu-Zied, Ramadan H.)

Mansoura Univ, Fac Sci, Dept Geol, Mansoura 35516, Dakahlia, Egypt

Abstract

The present study of the Abu Roash and Bahariya formations in well GPTSW-7 refines our understanding of the subsurface Cretaceous of the north Western Desert of Egypt. Our investigations are based on the palynological analyses of 71 cuttings samples, of which 24 have also been analyzed for geochemistry, in addition to 3 sidewall cores analyzed for vitrinite reflectance (R(o)).

Four palynological zones and three subzones in addition to a poorly fossiliferous interval ranging in age from Coniacian-Santonian to early Cenomanian are proposed. These include a poorly fossiliferous interval (Coniacian-Santonian), *Dinogymnium vozzhennikovae* Interval Zone (late to middle Turonian), *Ephedripites ambigtius*-*Ephedripites multicostatus*-*Foveotricolpites giganteus*-*Foveotricolpites gigantor-eticultus* Assemblage Zone (early Turonian), *Classopollis brasiliensis* Interval Zone (late to middle Cenomanian), and *Afropollis jardinus* Interval Zone (early Cenomanian). The succeeding subzones are; *Afropollis kahramanensis* Interval Subzone, *Elaterosporites klaszii* Interval Subzone and *Cretacaeiporites densimurus* Interval Subzone, all of early Cenomanian age.

Total organic carbon (TOC) and Rock-Eval pyrolysis and palynofacies analyses indicate that the Bahariya Formation and the Abu Roash G Member are primarily of kerogen III type and hence gas prone, suggesting a strong influence of hydrogen-enriched organic matter. The Abu Roash A, C-E Members may also be gas prone (type III kerogen) and appear to contain highly oxidized terrestrial organic matter. In contrast, the Abu Roash F Member has very high TOC and HI values and contains a very high proportion of amorphous organic matter (AOM) indicating a highly oil-prone facies. While this finding is not unexpected for anoxic black shale, it contrasts with earlier studies that suggest a gas prone nature. R. measurements show that the Bahariya Formation represents an immature-early genesis dry gas phase. This is also true for all investigated samples from the Abu Roash and Bahariya formations, based on their low thermal alteration index (TAI).

Quantitative and qualitative analyses of both the palynoflora and palynofacies show that the Abu Roash A and C Members (B is missing), both of Coniacian-Santonian age, represent oxic proximal and distal shelf environment. The Abu Roash D and E Members, dated as Turonian, represent oxic (proximal) shelf, whereas the Cenomanian Abu Roash F Member was deposited in a distal suboxic-anoxic basin. The Cenomanian Abu Roash G Member and the Bahariya Formation were deposited in a shallow marine and shallow marine to fluvio-deltaic setting, respectively.

The Senonian *Palmae* Province is recognized in the palynoflora. by the presence of *Proteacidites*, *Auriculiidites reticulatus*, *Ariadnaesporites*, *Gabonispors vigourouxii*. On the other hand the Albian-Cenomanian *Elaterates* Province is characterized by the presence of *Steevesipollenites*, *Gnetaceapollenites*, *Elaterocolpites*, *Elaterosporites*, *Elateroplicites*, *Senegalosporites*, *Sofrepites*, *Afropollis* and *Cretacaeiporites*. (C) 2009 Elsevier Ltd. All rights reserved.

Author Keywords: Palynology; Palynofacies; Organic Geochemistry; Cretaceous; Rock-Eval; Egypt

KeyWords Plus: DINOFLAGELLATE STRATIGRAPHY; SEDIMENTS; PALYNOSTRATIGRAPHY; BIOSTRATIGRAPHY; PALYNOMORPHS; MICROFOSSILS; SUBSURFACE; OASIS; SUDAN; SINAI

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5- Dinoflagellates from the Miocene Rudeis and Kareem formations borehole GS-78-1, Gulf of Suez, Egypt

El Beialy, SY (El Beialy, SY);
El Mansoura Univ, Fac Sci, Dept Geol, Mansoura 35516, Egypt
Ali, AS (Ali, AS)
Tanta Univ, Fac Sci, Dept Geol, Tanta 31527, Egypt

Abstract

The Miocene Rudeis and the Kareem formations encountered in the Neogene part of the GS-78-1 borehole, Gulf of Suez produced diverse assemblages of dinoflagellate cysts, spores and pollen. The Early Miocene (Burdigalian) age assigned to the Rudeis Formation and the Early-?Middle Miocene (Langhian-Serravallian) age postulated for the Kareem formation is based on the presence of dinoflagellate cysts. These offer a good basis for biostratigraphic correlation of the Miocene deposits in the Gulf of Suez with those in the Nile Delta and Sinai in Egypt, and also with those present in key sections from the Mediterranean, the Canadian offshore sequences, Northwest Europe and from the North Atlantic. The terrestrial palynoflora (spores and pollen) affords no really precise, independent testimony as to the age of the samples, apart from being generally indicative of a Neogene age, in accord with the established gross age of the sediments, derived mainly from planktonic forams, calcareous nannoplankton and dinoflagellate cysts.

The Rudeis Formation was deposited in a relatively deep water environment, based on the abundance fluctuations in miospores and dinoflagellates. However, the miospores recovered from the Rudeis Formation give an equivocal signal with respect to depositional environment. Such observed incursions of terrestrial elements in the Rudeis Formation could indicate that they might have been carried about within the basin of deposition by the waters of the Mediterranean Sea, or that they were displaced into a deep water setting. The overlying Kareem Formation was identified as an outer continental shelf deposit to upper bathyal (distal) environment because it contains a higher percentage of marine dinoflagellate cysts in most investigated samples, except in its uppermost part which shows the lowest percentage of marine forms. These include *Spiniferites ramosus*, *S. pseudofurcatus*, *Operculodinium centrocarpum*, *Polysphaeridium zoharyi*, *Systematophora placacantha* and *Lingulodinium machaerophorum*. The consistent presence of *P. zoharyi* in the Kareem Formation indicates that the Gulf of Suez was at times in the tropical to subtropical belt during the Early-?Middle Miocene age. (C) 2002 Elsevier Science Ltd. All rights reserved.

Author Keywords: dinoflagellates; Miocene; Rudeis; Kareem; Gulf; Egypt

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