Proceeding of the Third International & the Fifth Scientific Conference of College of Science - Tikrit University
Int.3, Loc.5, Article ID:2022-P4-13

Purposeful scientific research is a basic pillar for the advancement of Iraq

Lithofacies and Nannobiostratigraphy of Fat'ha Formation, Perman Anticline, Northern Iraq

Mujahed Khaled Ayoub, Amaar Jamad Mohammed, Faris Nijres Hussan
Department of Applied Geology, College of Science, University of Tikrit, Tikrit, Iraq

ABSTRACT

A surface section of the Fat'ha Formation (Middle Miocene) was studied in the Shaqlawa area, Erbil Northern Iraq. It consists of Clastic (mudstone), and carbonates (marly, marly limestone and limestone).These sequences variable thickness based on rocky differences**.** The lower boundary is unconformatiy with Pelispi Formation to founded basal conglomerate. The upper boundary sequence with the Injana Formation is conformable. The sedimentary structures were distinguished in the formation within the Shaqlawa region include, mudstone flaser, lamination and lenses also marly Planar and lamination bedding with sequencec marly limestone planar, thinly to laminated and flaser bedding, wavy laminations stromatolites and limestone thinly, massive bedded.

Calcareous nannofossils assemblages are diagnosed from twenty one samples from Fat'ha Formation at Perman anticline, Northeastern Iraq. The objective of this study is to determine the geologic age of this formation which is detailed investigation is carried out, during which eighteen species of calcareous nannofossils identified.

The recorded calcareous nannofossil assemblages include one biozone which are from the section, *Helicosphaera ampliaperta* Interval Biozone. This biozone is correlated with other calcareous nannofossils biozones from both local and regional sections that lead to conclude the age of the Early Miocene (Burdigalian). Our detailed analysis of the sedimentary succession focuses on the two main lithofacies (siliciclastics, carbonates).

Keywords: Calcareous Nannofossils; biostratigraphy; stratigraphy; Fat'ha Formation; Miocene.

Introduction

The Fat'ha Formation has been described in numerous papers and several books (Dunnington, 1958; van Bellen *et al.,* 1959; Shawkat and Tucker, 1978; Buday, 1980; Jassim and Buday, 2006). The study area lies (36°21'39.3"N) (44°10'56.6"E), within the unstable shelf high folded zone. The Lower- Middle Miocene cycle an important cycle in the Tertiary which include reservoir and seal rocks (Buday and Jassim 1987). This cycle was divided in- to two subcycles, the Lower Miocene subcycle and the Middle Miocene subcycle. The succession formation can be divided into several third-order cycles, which reflect fluctuations in the relative sea-level rise (Jassim and Buday,2006).

The aim of current study lithofacies and systematic nannopalaeontology of the species belonging to calcareous nannofossils with determining the stratigraphic range of them in the studied section the age determination.

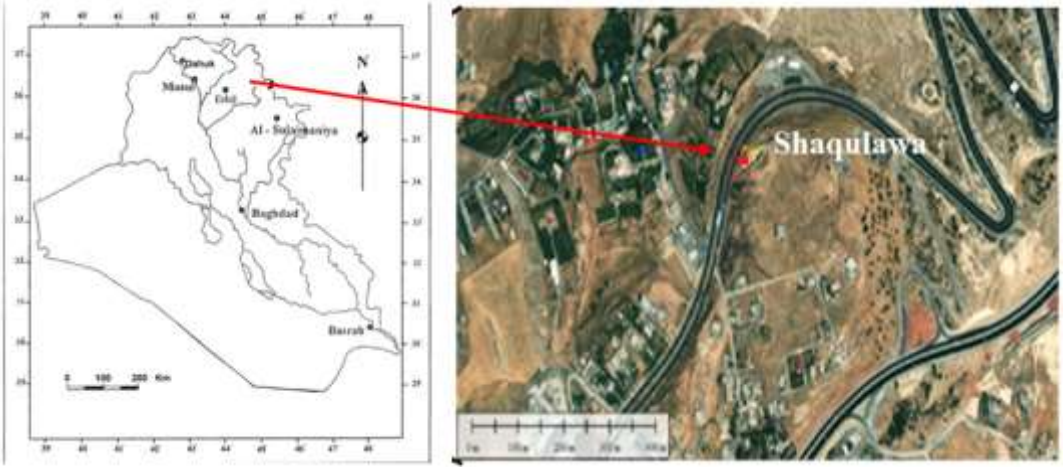

Fig.1: Structural map of Iraq show the location of section Shaqlawa.

Materials and Methods

Twenty one samples were obtained from outcrop represent Fat'ha Formation section from the location of Perman village, Northeastern Iraq. Select the best section and description structures sedimentary thickness of beds and types of lithology in the field. Thin sections are prepared for the polarized microscope examination. The extraction of the calcareous nannofossils was done by following the approach of manner pursued by many researchers in this field such as in (Armstrong and Braiser, 2005) as follow:

About (5) grams of each rock sample is crushed to pass through a sieve of (45) µm and then soaked in filtered water. A small size drop is added to implement as a dispersant.

A direct low heat source (hotplate) is used to lasting dry the slide and residue, taking into account during all stages of work, be careful and avoid contamination.

Amorphous oleoresin called (Canada balsam) has been placed over an uncontaminated thin cover slip. Then it is flipped over the previously placed dry drop of crushed sample solution and left to dry and stick well, so the sample is then ready for examination under the transmitted microscope.

Lithofacies:

The lower contact surfaces of the Fat'ha Formation unconformable , upper contact surface gradual (Bellen *et al*., 1959; Buday and Hak,1980). The study of area Fat'ha Formation contact lower surface represent Plispi Formation is surface unconformable, consist of pebbly sandstone with green gluconite minerals thickness 0.5cm, (PlateA-1).The upper contacts with Injana Formation as conformable surface consist of sandstone thickness 2m ,(Plat1-B) . The Fat'ha Formation in terms of two main lithofacies These are: Clastic red mud rocks,carbonates: Marly, Marly limestone, arenaceous limestone and limestone (Figure-2).

Plate-1 A: Lower contact Plispi Formation (Pl) with Fatha Formation

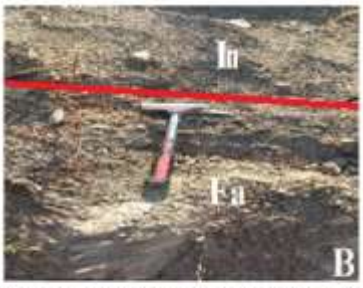

Plate-1B: Upper contact Fatha Formation with Injana Formation

Clastics: Mudstone

The mudstone is carbonate-rich, and include marls, and silty marls. These occur in beds 0.3–5 m thick in the lower member to 6.0 m in the upper. The sediments are laminated to thickly bedded and commonly exhibit conchoidal fracture. They contain abundant fossils, including Gastropods, Pelecypods and Oysters. The mudstone is grey, green or red; the yellowish grey marl is sometimes referred to as the Basal Marl because it is generally found at the base of high-frequency cycles,Plate-2B.

Carbonates, Marly Limestone and Arenaceous Limestone

Carbonates generally form about(15%) of the total Fatha Formation sediments. The thicknesses of these units ranges from 0.5 to 10.0 m, with individual bed thicknesses decreasing upwards in the succession. Highly fossiliferous beds occur in the studied carbonate sections with common shell fragments,

usually recrystallized. Two main limestone lithofacies have been identified: marly and arenaceous (detrital).

Marly Limestone:

yellowish grey, thinly bedded to laminated and generally fossiliferous. Internal structures are rare, but include flaser bedding, wavy laminations stromatolites that alternate with arenaceous limestones. Marly limestones occupy the lower part of most carbonate horizons, but become increasingly dolomitic with a marked reduction in fossil content upwards, Plate-2B

Arenaceous Limestone: whitish grey, brown to yallow visibly detrital with fossils, very hard, thinly bedded and overlain by marl and marly limestones.

Plate-2A: Red mudstone soft

Plat-2B: Marly limestone hard

Nannobiostratigraphy and Age

Calcareous nannofossil biostratigraphic studies were carried out on outcropped samples obtained from Fat'ha Formation . The focus of this study was to establish a nannobiozonation, age, and correlation across the study section. Lithologically, the study sequences composed of carbonate with intercalation of thin-bedded clastic. Fairly diverse nannofossil assemblages

were recovered, calcareous nannofossils zone was established based on first and last occurrences of readily identifiable marker species and their relative abundances. This zone aided the age assignment of Early Miocene (Burdigalian) to the studied section. Marker species and assemblage diagnostic types such as *Helicosphaera ampliaperta*, have been used in the designation of the zonal age ranging CN3 based on the classic zonation scheme of Okada and Bukry (1980). This biozone roughly agreed with the lower part of biozone NN4 in Martini, 1971 and is nearly congruent to biozone CN3 in Okada and Bukry, 1980 .The latter used the acme of *D. deflandrei* to define the top of biozone CN3, while the apparition of Discoaster is used here as a marker for the zonation boundary, therefore it concluded the age of this biozone is Early Miocene(Burdigalian) based on Ogg *et al*., 2016.

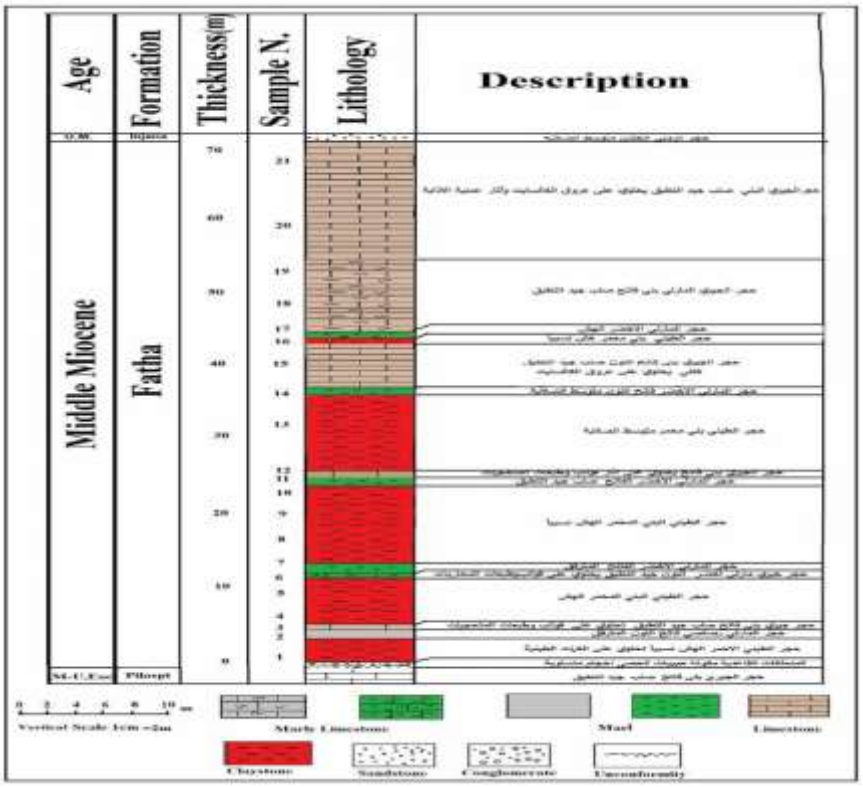

Fig.2: Sequences Fat'ha Formation of the study area (Shaqlawa section).

Results and Discussions

- Systematic paleontology (Fig.3,4,5)

Family Helicosphaeraceae Black, 1971

Genus *Helicosphaera* Kamptner, 1954

Helicosphaera ampliaperta Bramlette and Wilcoxon,1967

Helicosphaera intermedia Martini, 1965

Helicosphaera sellii Bukry and Bramlette, 1969

Family Coccolithaceae Poche, 1913

Genus *Coccolithus* Schwartz,1894

Coccolithus miopelagicus Bukry,1971

Coccolithus pelagicus (Wallich, 1877) Schiller, 1930

Genus *Erocsonia* Black, 1964

Erocsonia formosa (Kamptner, 1963) Haq, 1971

Family Noelaerhabdaceae Jerkovic, 1970

Genus *Cyclicargolithus* Bukry, 1971

Cyclicargolithus floridanus (Roth and Hay in Hay, Mohler and Roth, 1967) Bukry, 1971

Genus *Dictyococcites* Black,1967

Dictyococcites bisectus (Hay, Mohler and Wade, 1966) Bukry and Percival, 1971

Genus *Reticulofenestra* Hay, Mohler and Wade,1966

Reticulofenestra dictyoda (Deflandre in Deflandre and Fert, 1954) Stradner in Stradner and Edwards, 1968

Family Prinsiaceae Hay and Mohler, 1967

Genus *Prinsius* Hay and Mohler, 1967

Prinsius sp.

Genus *Toweius* Hay and Mohler, 1967

Toweius occultatus (Locker, 1967) Perch - Nielsen, 1971

Family Discoasteraceae Tan, 1927

Genus *Discoaster* Tan,1927

Discoaster cubensis Furrazola and Iturralde, 1967

Discoaster cf. *deflandrei* Bramlette and Riedel, 1954

Discoaster distinctus Martini, 1958

Discoaster nobilis Martini, 1961

Family Sphenolithaceae Deflandre, 1952 in Grasse´, 1952

Genus *Sphenolithus* Deflandre in Grasse´, 1952

Sphenolithus conicus Bukry, 1971

Sphenolithus moriformis (Bronnimann and Stradner, 1960) Bramlette and Wilcoxon, 1967

Family Triquetrorhabdulaceae Lipps, 1969

Genus *Triquetrorhabdulus* Martini, 1965

Triquetrorhabdulus challenger Perch-Nielsen, 1977

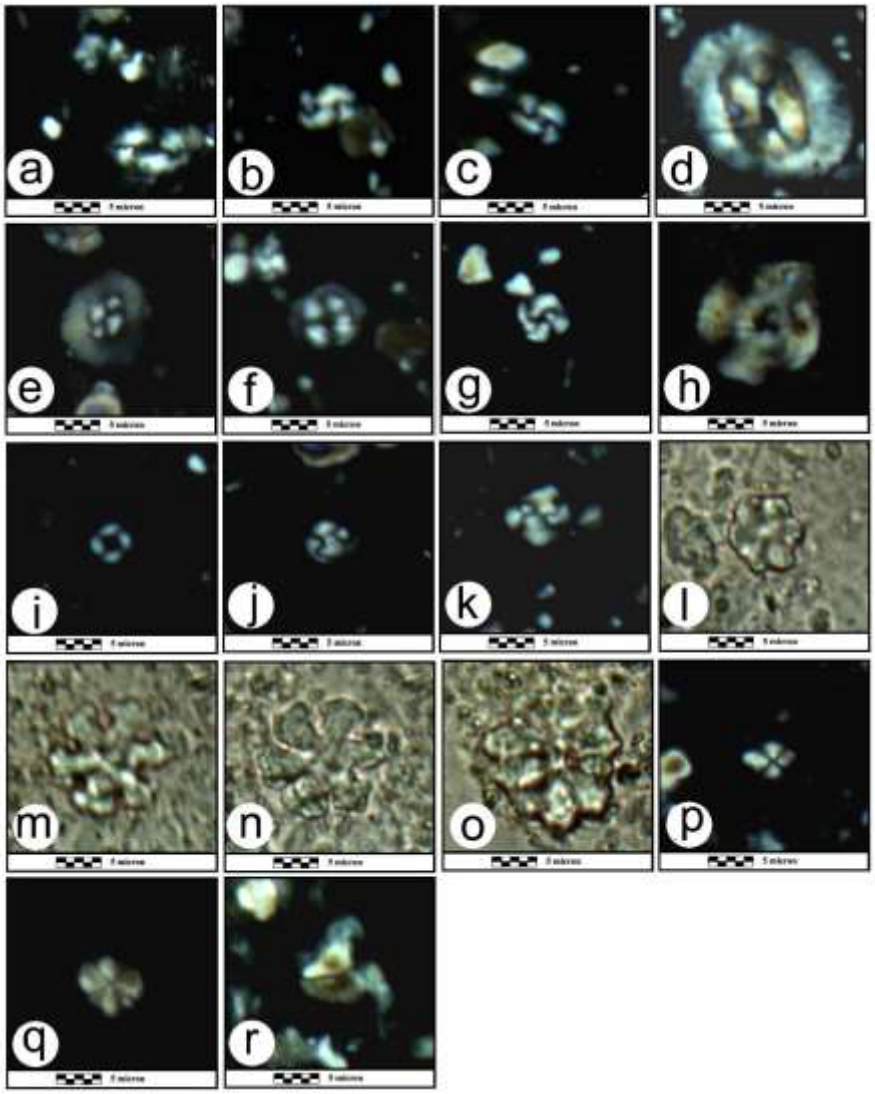

Fig. 3: Microscopic photos of significant calcareous nannofossil taxa from Fat'ha Formation. (a) *Helicosphaera ampliaperta*; (b) *Helicosphaera intermedia*; (c) *Helicosphaera sellii*; (d) *Coccolithus miopelagicus*; (e) *Coccolithus pelagicus*; (f) *Erocsonia formosa*; (g) *Cyclicargolithus floridanus*; (h) *Dictyococcites bisectus*; (i) *Reticulofenestra dictyoda*; (j) *Prinsius* sp.; (k) *Toweius occultatus*; (l) *Discoaster cubensis*; (m) *Discoaster* cf. *deflandrei*; (n) *Discoaster distinctus*; (o) *Discoaster nobilis*; (p) *Sphenolithus conicus*; (q) *Sphenolithus moriformis*; (r) *Triquetrorhabdulus challenger*.

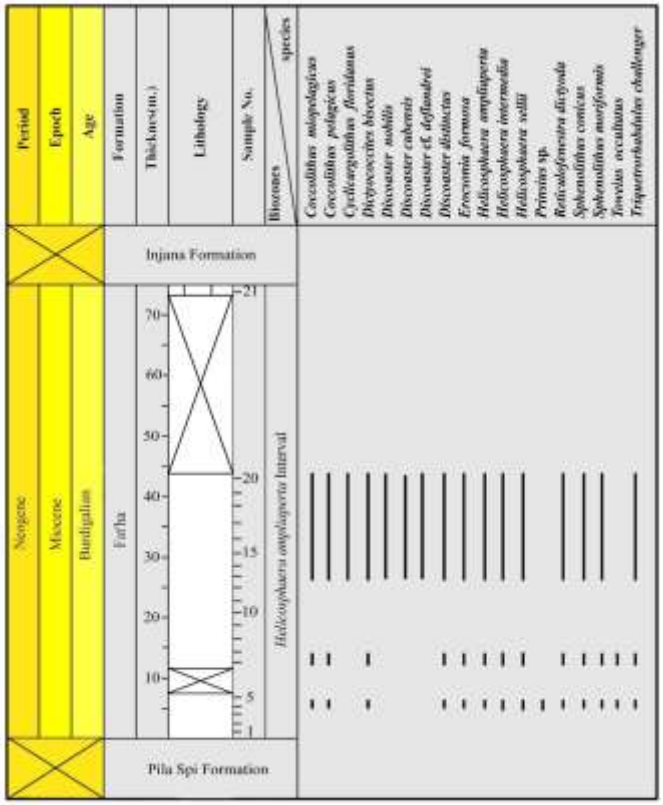

Fig.4: Distribution chart for calcareous nannofossils of studied section

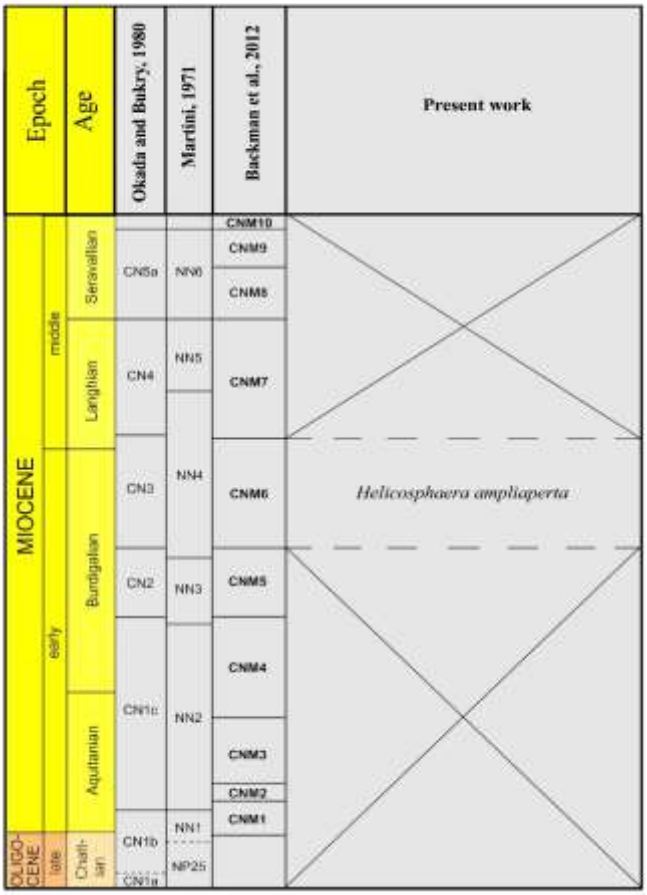

Fig. 5: Correlation chart for calcareous nannofossils of studied section

Conclusions

1. The Fatha Formation consists of mudstone, marly, marly limestone and limestone.
2. The lower boundary is unconformatiy with Pelispi Formation to founded basal conglomerate, which the upper boundary with the Injana Formation is conformable.
3. The sedimentary structures were distinguished include mudstone bedded, flaser, lamination and lenses also marly Planar and lamination bedding with sequencec marly limestone (hard contain moldic fossils) planar, thinly to laminated and flaser bedding, wavy laminations stromatolites and limestone (whitish grey, brown to yallow very hard with contain veins calcite), thinly, massive bedded.
4. Eighteen species of calcareous nannofossils identified.
5. The recorded calcareous nannofossils assemblages include one biozone which is part of the section: *Helicosphaera ampliaperta* Interval Biozone (CNM6)
6. This biozone is correlated with other calcareous nannofossils biozones from both local and regional sections that lead to conclude the age of the Early Miocene (Burdigalian).

References

Armstrong, H. and Brasier, M., 2005. Microfossils. Blackwell Publishing, pp. 1-305 Bellen, R.C. Van, Dunnington, H.V ., Wetzel, R. and Morton, D. M., 1959. Lexique stratigraphique international, V.III: Asie, Fascicule 10 a, Iraq. 333 p.

Bellen, R. V., Dunnington, H. V., Wetzel, R., & Morton, D. (1959). Lexique stratigraphique international. Asie, Iraq, 3(10a), 324.

Bellen, R.C., Dunnington, H.V., Wetzel, R. and Morton, D.M. 1959. Lexique Stratigraphique International. V.III: Asie , Fascicule 10 a, Iraq. 333 p.

Bramlette, M. N., & Wilcoxon, J. A. (1967). Middle Tertiary calcareous nannoplankton of the Cipero section, Trinidad, WI. Tulane Studies in Geology and Paleontology, 5(3).

Buday, T., & Hak, J. (1980). REPORT ON THE GEOLOGICAL SURVEY OF THE WESTERN PART OF THE WESTERN DESERT, IRAQ.

Buday, T., & Jassim, S. Z. (1987). The regional geology of Iraq, vol. 2: tectonism, magmatism and metamorphism. *GEOSURV, Baghdad, 352pp*.

Congrès géologique international. Commission de stratigraphie, van Bellen, R. C., Dunnington, H. V., R.. Wetzel, & Morton, D. M. (1959). *Lexique Stratigraphique International: Asie. Iraq. Tertiary. Mesozoic and Palaeozoic*. Centre National de la Recherche Scientifique.

Deflandre, G., & Fert, C. (1954). Observations sur les coccolithophoridés actuels et fossiles en microscopie ordinaire et électronique.

Dunnington, H. V. (1958). Generation, migration, accumulation, and dissipation of oil in northern Iraq: Middle East.

Gradstein, F.M., Ogg, J.G., Schmitz, M.D. and Ogg, G.M. 2012. The geologic time scale. The Boulevard, Langford lane, Kidlington, Oxford OX5 1GB, UK,2,437-1144.

Jassim, S. Z., & Goff, J. C. (Eds.). (2006). *Geology of Iraq*. DOLIN, sro, distributed by Geological Society of London.

Martini, E., 1971. Standard Tertiary and Quaternary calcareous nannoplankton zonation. In Farinacci, A., (Ed.), Proceedings II Planktonic Conference, Roma, 1970, 2, pp. 739-785, 4 pls., 6 tables.

Ogg, J. G., Ogg, G., & Gradstein, F. M. (2016). A concise geologic time scale: 2016. Elsevier.

Okada, H. and Bukry, D., 1980. Supplementary modification and introduction of code Numbers to low-latitude coccolith biostratigraphy zonation. (Bukry, 1973,1975).Marine Micropaleont., 5(3),321- 326.

Perch-Nielsen, K. A. T. H. A. R. I. N. A. (1971). Neue Coccolithen aus dem Palaozan von Danemark, der Bucht von Biskaya und dem Eozan der Labrador See. Bulletin of the Geological Society of Denmark, 21(01), 51-66.

Shawkat, M. G., & Tucker, M. E. (1978). Stromatolites and sabkha cycles from the Lower Fars Formation (Miocene) of Iraq. Geologische Rundschau, 67(1), 1-14.