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CALCAREOUS NANNOFOSSILS BIOSTRATIGRAPHY OF JADDALA FORMATION IN (KH1) WELL, WESTERN IRAQ

Rahme Fares Al-Sulevani* and Omar Ahmed Al-Badrani*

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Abstract

A thorough investigation of calcareous nannofossils from the Jaddala Formation in Western Iraq in (Kh1) well has been undertaken. Twenty four species of calcareous nannofossils are reported in eleven genera belonging to eight families as followings Helicosphaeraceae family by the genus *Helicosphaera* (*H. ampliaperta*, *H. compacta* , *H. lophota*, *H. salebrosa*, *H. seminulum*), Zygodiscaceae family by the genus ***Nannotetrina*** (*N*. ***cf. cristata***), Rhabdosphaeraceae family by the g**enus *Blackites*(*Blackites* sp.)**, Coccolithaceae family by the genus *Coccolithus* (*C. miopelagicus*, *C. pelagicus*, *C. staurion*) and the genus *Erocsonia* (*E. formosa*, *Erocsonia* sp.) Noelaerhabdaceae family by the genus *Cyclicargolithus*(*Cy. Abisectus)*, the genus *Dictyococcites* (*D. bisectus*) and the genus *Reticulofenestra*(*R. dictyoda* and *R. umbilicus*), Prinsiaceae family by the genus *Toweius* (*T. occultatus* and *T. pertusus*), Discoasteraceae family by the genus *Discoaster* (*D. bifax*, *D. deflandrei* , *D.* cf. *nodifer*, *D. saipanensis*) and the Sphenolithaceae family by the genus *Sphenolithus* (*S. obtusus* and *S. pseudoradians*).

It is a three biostratigraphic zone that has been observed, and its age has been estimated as middle Eocene for the Jaddala Formation. *Coccolithus staurion* Partial range biozone (CP13c)*; Discoaster bifax* Partial range biozone (CP14a) *and Discoaster saipanensis* total range biozone (CP14b). Therefore, we suggested the middle Eocene (Lutetian to Bartonian).

Key words: Biostratigraphy, Calcareous, Eocene, Nannofossils, Iraq, Jaddala.

*Dept. of Geology, College of Science, Mosul University, Iraq.

*Corresponding author email: omarbadrani@uomosul.edu.iq

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Introduction

Henson originally identified the Jaddala Formation in 1940, using a type site close to Jaddala Village in northern Iraq (Bellen et al., 1959). The Jaddala Formation outcropping then appeared in a small territory of Mountain Sinjar, Northwestern Iraq, in the Foothill Zone.

The Eocene period encompassed the majority of the northern strata. Numerous authors have investigated the stratigraphic succession of the Eocene in Iraq using calcareous nannofossils, including Al-Badrani (2007), Al-Badrani (2011), Al-Badrani and Al-Nima (2010), Al-Badrani and Al-Ubaidi (2012), Al-Badrani and Al-Zubaidi (2015), Al-Badrani and Al-Zuba (2021). The current study's objective is to establish the Jaddala Formation's age through the analysis of calcareous nannofossils.

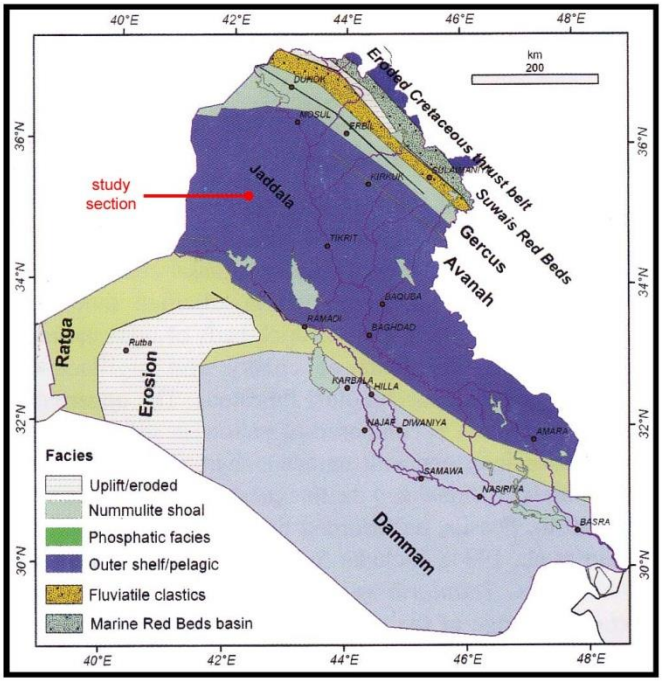

Fig.1. Paleofacies map of Middle Eocene of Iraq showing study section

Materials and Methods

A Detailed study of calcareous nannofossils has been carried out for stratigraphic successions of Jaddala Formation about 105 meter consist of limestone and marly limestone, using the for 19 cutting samples by using light microscope, the extracted calcareous nannfossils are by using the Armstrong and Brasier (2005) methods for paleontological studies.

When it is taken from the rocks, it is a method of extraction for microfossils that can be carefully investigated.

The disaggregated sample is mixed in distilled water with a drop of a dispersant to produce smear slides, which are a technique for producing slides of calcareous nanofossils.

A heated heater is used to dry the cover slip. Allow the slide and residual material to cure at a low temperature and away from possible sources of contamination to produce real mounts. A clean cover slip should have a drop of mounting media (such as Canada Balsam) on it. Place the clean cover slip over the residue. Before examining with transmitted light, let it dry.

Results and Discussion

The purpose of systematic categorization is to identify the 24 species and to describe the significant calcareous nannofossils from the Jaddala Formation in western Iraq. The higher taxonomy generally follows the Perch-Nielsen (1985) and Young and Bown (1997) scheme. The data and images are preserved in the Department of Geology at the University of Mosul's Science College.

1- Nannopaleontology

I- Heterococcoliths

Family Helicosphaeraceae Black, 1971

Genus *Helicosphaera* Kamptner, 1954

Helicosphaera ampliaperta Bramlette and Wilcoxon, 1967

Helicosphaera compacta Bramlette and Wilcoxon, 1967

Helicosphaera lophota Bramlette and Sullivan, 1961

Helicosphaera salebrosa Perch-Nielsen, 1971

Helicosphaera seminulum Bramlette and Sullivan, 1961

Family Zygodiscaceae Hay and Mohler, 1967

Genus *Nannotetrina* Achuthan and Stradner, 1969

Nannotetrina cf. cristata (Martini, 1958) Perch - Nielsen, 1971

Family Rhabdosphaeraceae Lemmermann, 1908

Genus *Blackites* Hay and Towe, 1962

Blackites sp.

Family Coccolithaceae Poche, 1913

Genus *Coccolithus* Schwarz, 1894

Coccolithus miopelagicus Bukry, 1971

Coccolithus pelagicus (Wallich, 1877) Schiller, 1930

Coccolithus staurion Bramlette and Sullivan, 1961

Genus *Erocsonia* Black, 1964

Erocsonia formosa (Kamptner, 1963) Haq, 1971

Erocsonia sp.

Family Noelaerhabdaceae Jerkovic, 1970

Genus *Cyclicargolithus* Bukry, 1971

Cyclicargolithus abisectus (Muller , 1970) Wise, 1973

Genus *Dictyococcites* Black, 1967

Dictyococcites bisectus (Hay, Mohler and Wade, 1966) Roth, 1970

Genus *Reticulofenestra* Hay, Mohler and Wade, 1966

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

Reticulofenestra umbilicus (Levin, 1965) Martini and Ritzkowski, 1968

Family Prinsiaceae Hay and Mohler, 1967

Genus *Toweius* Hay and Mohler, 1967

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

Toweius pertusus (Sullivan, 1965) Romein, 1979

II– Nannoliths

Family Discoasteraceae Tan, 1927

Genus *Discoaster* Tan, 1927

Discoaster bifax Bukry, 1971

Discoaster deflandrei Bramlette and Riedel, 1954

Discoaster cf. *nodifer* (Bramlette and Riedel, 1954) Bukry, 1973

Discoaster saipanensis Bramlette and Riedel, 1954

Family Sphenolithaceae Deflandre, 1952

Genus *Sphenolithus* Deflandre, 1952

Sphenolithus obtusus Bukry, 1971a

Sphenolithus pseudoradians Bramlette and Wilcoxon, 1967

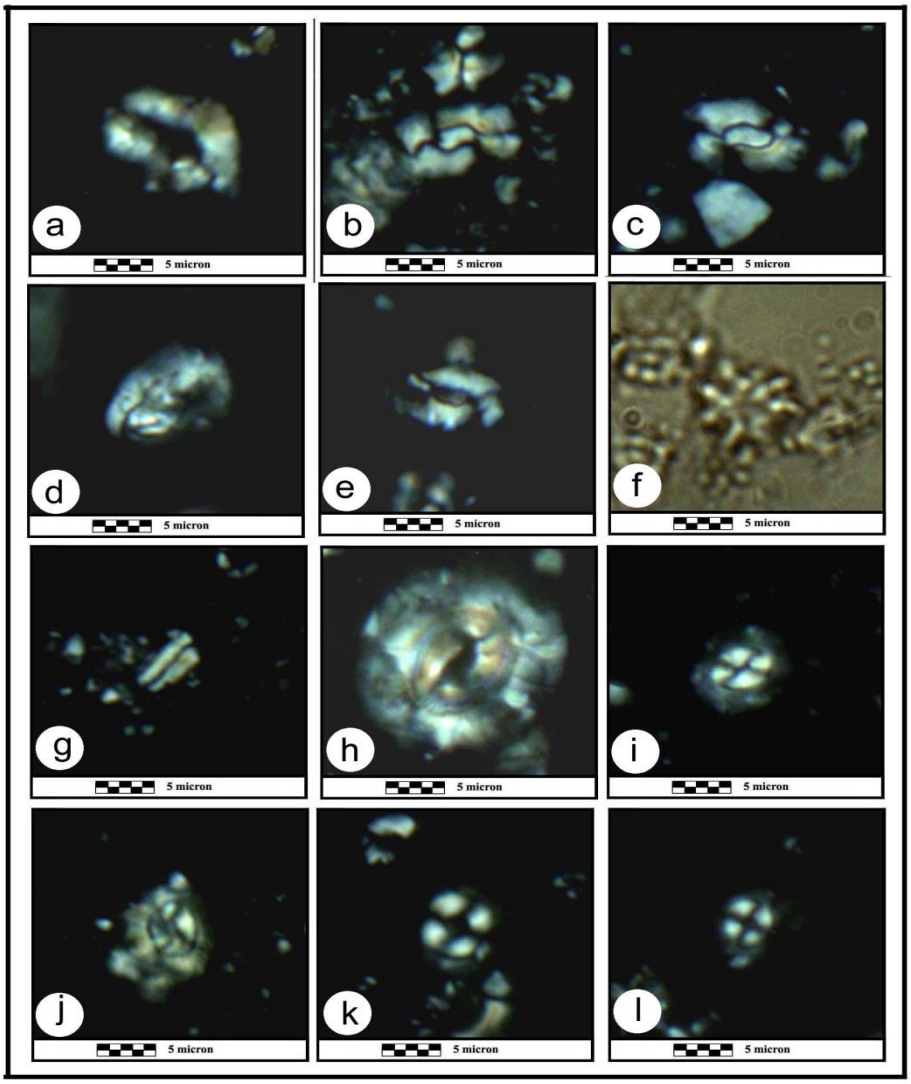

Fig.2. (a) *Helicosphaera ampliaperta*; *(b) Helicosphaera compacta*; *(c) Helicosphaera lophota*; (d) *Helicosphaera salebrosa*; *(e) Helicosphaera seminulum* ; **(f) *Nannotetrina cf. cristata***; **(g) *Blackites* sp.;** *(h) Coccolithus miopelagicus*; (i) *Coccolithus pelagicus;(j) Coccolithus staurion*; (k) *Erocsonia formosa*; (l) *Erocsonia* sp.

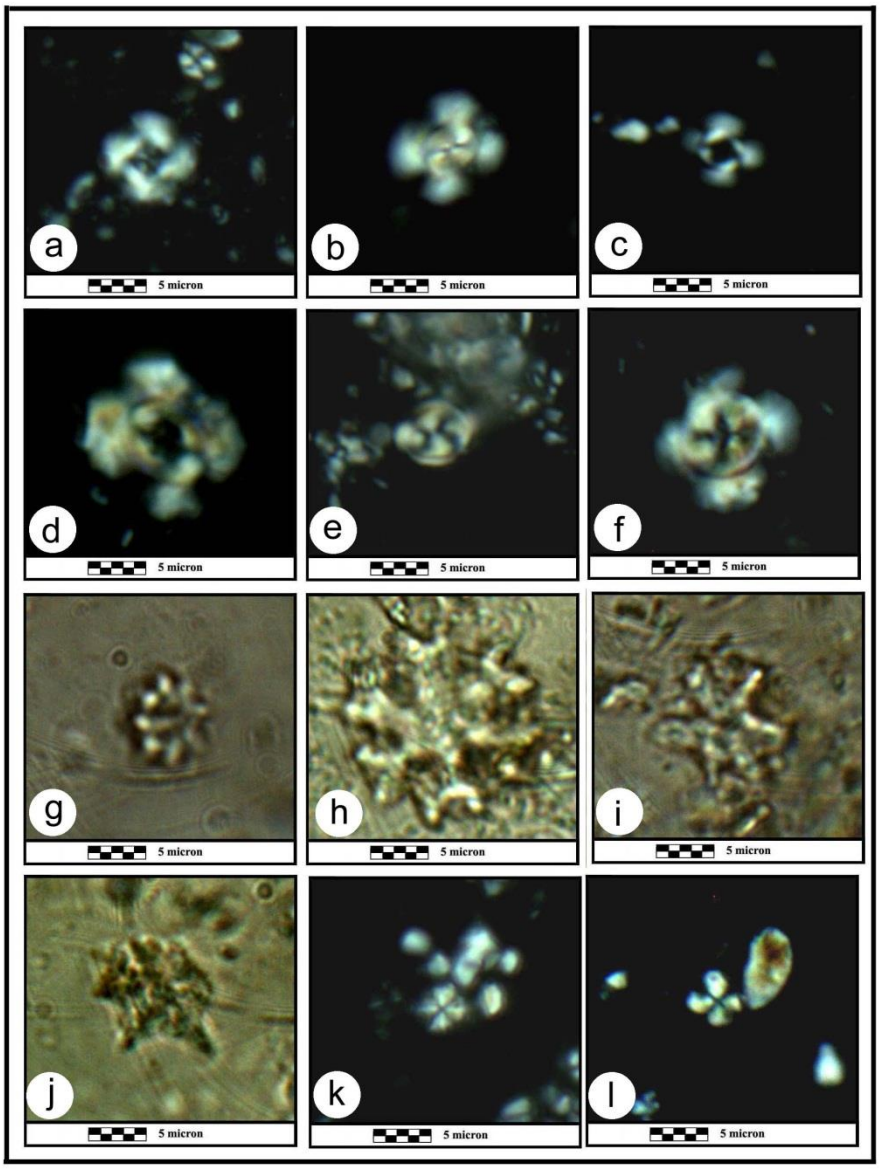

Fig.3. *(a) Cyclicargolithus abisectus ;* (b) *Dictyococcites bisectus*; (c) *Reticulofenestra dictyoda*; *(d) Reticulofenestra umbilicus*; (e) *Toweius occultatus*; (f) *Toweius pertusus*; *(g) Discoaster bifax*; (h) *Discoaster deflandrei*; (i) *Discoaster* cf. *nodifer*; (j) *Discoaster saipanensis*; (k) *Sphenolithus obtusus*; (l) *Sphenolithus pseudoradians*.

2- Nannobiostratigraphy

- *Coccolithus staurion* partial biozone (CP13c)

It is a Partial range biozone of *Coccolithus staurion* that determinate by LO of *Chiasmolithus gigas*, to the FO of *Discoaster bifax.* It is ranging between (960-940)m. in depths. This biozone is correlated to the upper portion of the biozone *Nannotetrina fulgens* that was studied by Martini (1971) and to the biozone *Coccolithus staurion* that was studied by Okada and Bukry (1981) that was aged of the middle Eocene (Lutetian). This biozone also corresponds to the biozone *Nannotetrina* spp. that was studied by Agnini et al. (2014) that (Gradstein et al.,2016).

- *Discoaster bifax* total range biozone (CP14a)

It is a Partial range biozone of *Discoaster bifax*.that determinate by FO of *Discoaster bifax*, to the LO of *Discoaster bifax.* It is ranging between (940 - 890)m. in depths. This biozone is correlated to

Discoaster tanii nodifer, which was studied by Martini in 1971, and to *Discoaster bifax*, which was studied by Okada and Bukry in 1981, both of which are from the middle Eocene (Lutetian to Bartonian). This biozone also corresponds to *Reticulofenstra umbilicus* and *Cribrocentrum reticulatum*, which were both studied by Agnini et al., 2016 (Gradstein et al.,2012).

- *Discoaster saipanensis* Partial biozone (CP14b)

It is Partial range biozone of *Discoaster saipanensis*.that determinate by last occurrence of LO of *Discoaster bifax*, to the FO of *Chiasmolithus oamaruensis* (Deflandre, in Deflandre and Fert, 1954) Hay *et al.*, 1966. It is ranging between (890-855)m. in depths. This biozone is correlated to *Discoaster saipanensis*, which was studied by Martini in 1971 and by Okada and Bukry in 1981. It also corresponds to the middle Eocene (Bartonian) biozones *Dictyccocites bisectus*/*Sphenolithus obtusus* and *Chiasmolithus grandis*, which was studied by Agnini et al. in 2014. As a result (Gradstein et al.,2016).

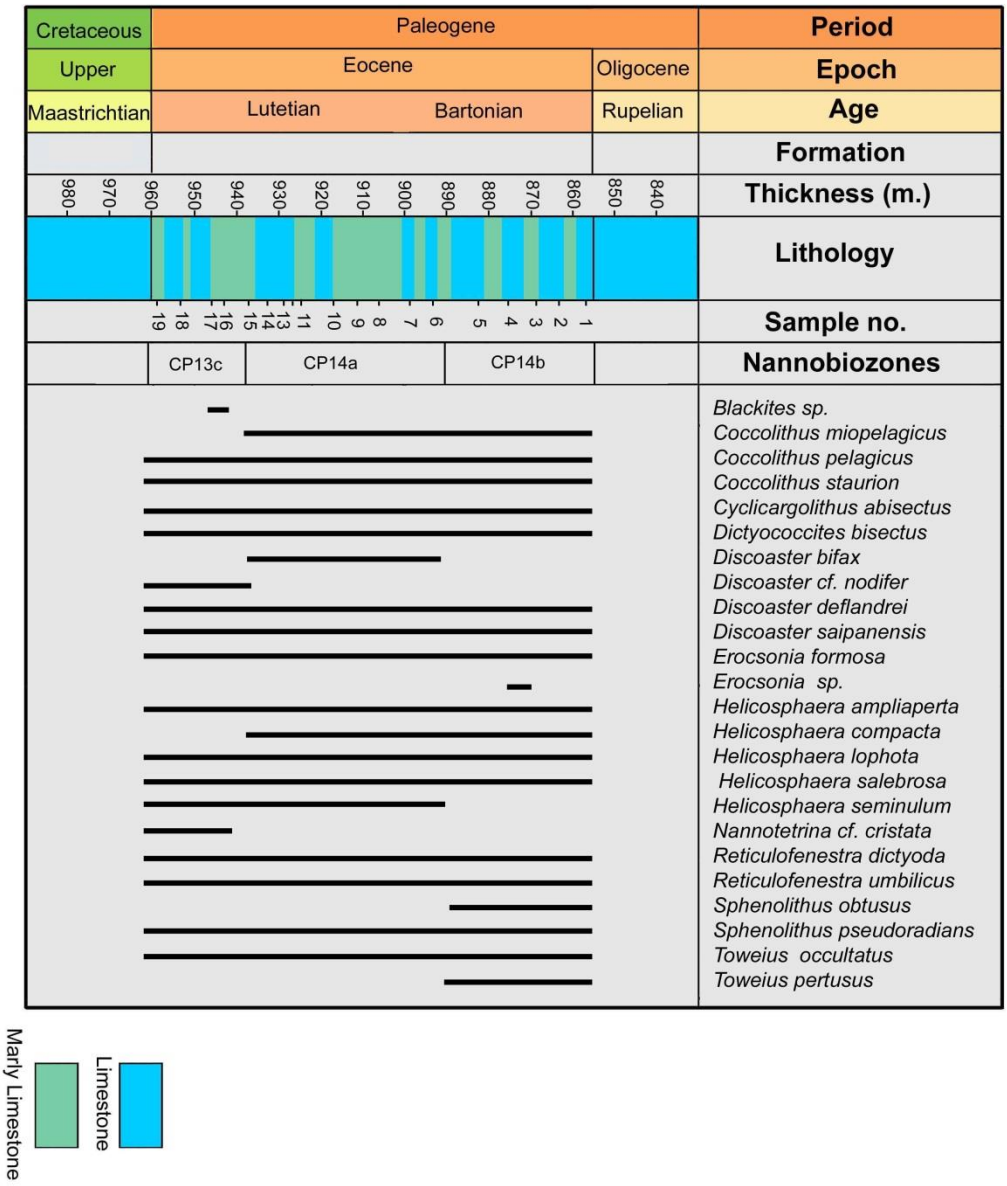

Fig.4. Distribution chart of calcareous nannofossils throughout studied section

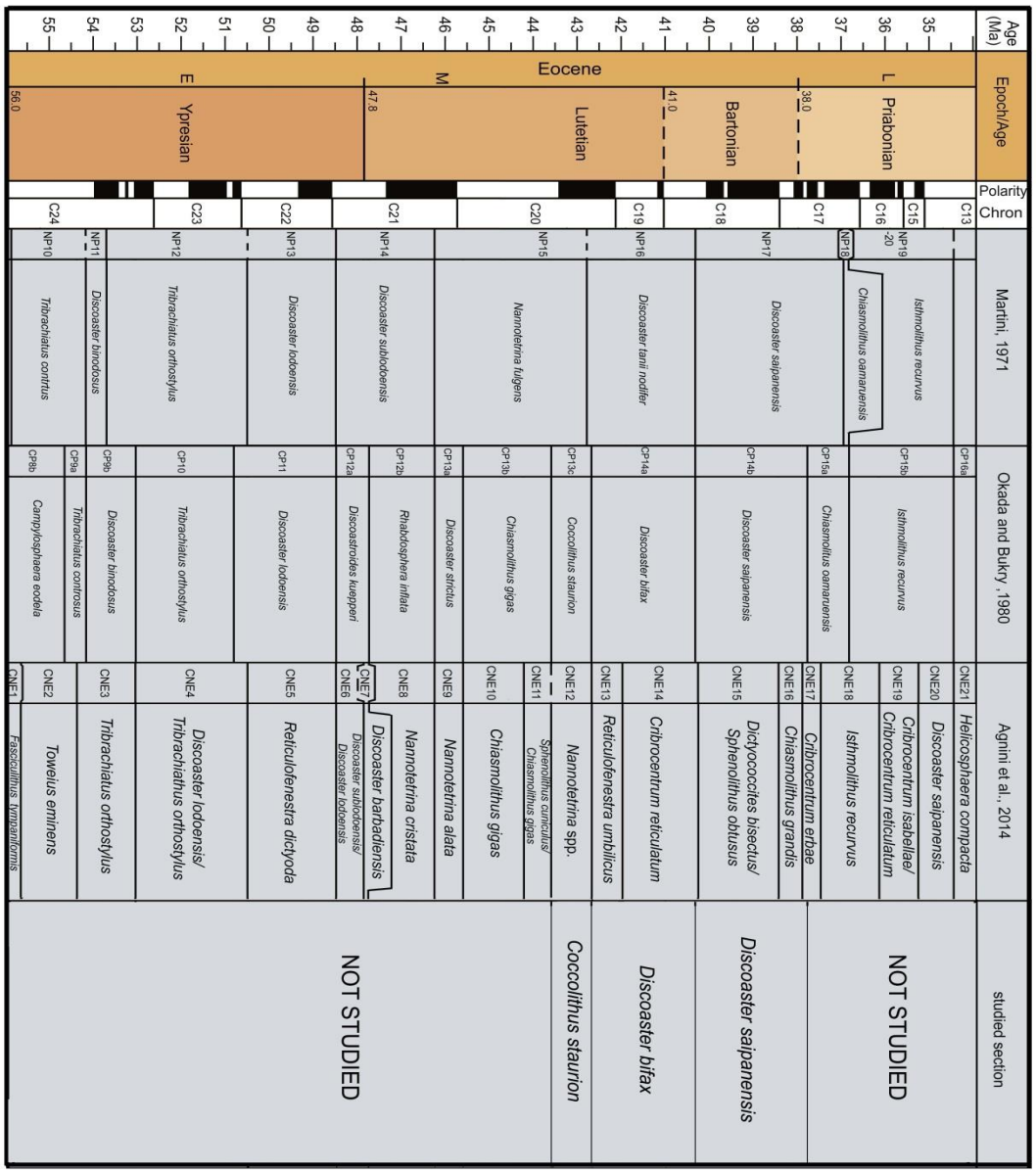

Fig.5. Comparted chart of calcareous nannofossils biozones for studied section

Conclusions

The Jaddala Formation in (Kh1) well have three biostratigraphic zones, these are:

- *Coccolithus staurion* Partial range biozone (CP13c)
- *Discoaster bifax* Partial range biozone (CP14a)
- *Discoaster saipanensis* total range biozone (CP14b)

Therefore, we suggested the middle Eocene (Lutetian to Bartonian) (Gradstein et al.,2012).

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