

Larger Foraminifera (Alveolinidae, Soritidae and Nummulitidae) from the Former Qulqula Conglomerate Formation, Kurdistan Region, Northeastern Iraq

Imad M. Ghafor **Mushir M. Qadir**
Department of Geology
College of Science
Sulaimani University

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ABSTRACT

The most recent studies reformed the occurrence of Qulqula Conglomerate Formation where they combined with Red Bed Series. The present palaeontological study, in the type locality, aids the recognition of the formation. Twenty species from the three families of Alveolinidae, Soritidae and Nummulitidae are described and figured from the former Qulqula Conglomerate Formation (present Red Bed Series) in Kurdistan Region, Northeastern Iraq. These assemblages indicate the age of the source area as Late Paleocene _ Middle Eocene age. The vertical and lateral distributions of the assemblages are discussed. The pebbles and boulders that bearing the recognized assemblages are derived by erosion from the source area (affiliated to Walsh _ Naoperdan Group) and deposited during later ages (younger ages) that more likely they deposited during Late Eocene age.

**الفورامينيفيرا الكبيرة (الفيولينيدي، سورتيدي و نيوميوليتيدي) ضمن تكوين قلقله
المدملكاتي السابق، اقليم كردستان، شمال شرق العراق**

عماد محمود غفور مشير مصطفى قادر

قسم علوم الارض

كلية العلوم

جامعة السليمانية

المخلص

معظم الدراسات الحديثة دمجت تواجد تكوين قلقله المدملكاتي مع سلسلة الطبقات الحمراء. الدراسة الحالية تؤيد هذا الدمج، وعليه تم دراسة ثلاثة عوائل تابعة للفورامينيفيرا القاعية الكبيرة. تم تشخيص ٢٠ نوعاً داخل الحصى والجلاميد المتواجدة ضمن تكوين قلقله المدملكاتي تعود الى عمر الباليوسين المتأخر _ الايوسين الاوسط. ان دراسة التوزيع الافقى و العامودي للحصى والجلاميد الحاملة للفورامينيفيرا القاعية الكبيرة

تشير الى كونها قد تعرت من الصخور المصدرية (بعمر الباليوسين المتأخر_ الايوسين الاوسط) والتي قد تكون صخور مجموعة والاش نوبردان، وترسبت ضمن صخور ما يسمى تكوين قفلة المدملكاتى خلال الايوسين المتأخر او ما بعد ذلك.

INTRODUCTION

The studied area is located within Sulaimani Governorate in northeastern Iraq. It forms a narrow belt extending from Halabja town, in the southeast to Qandil mountain toe near the Qulqula village at the northwest. (Fig.1), this area is located at latitude ($36^{\circ} 19' 12''$ _ $36^{\circ} 18' 30''$) and longitude ($45^{\circ} 10' 15''$ _ $45^{\circ} 09' 44''$).

The studied area now consist of high mountains which trending northwest southeast, between these mountains there are narrow or wide subsequent (strike) valleys. The mountains and valleys are dissected by; at least, two long consequent valleys and tens of smaller ones. In this area, the Qulqula Group comprise of Qulqula Radiolarian and Qulqula Conglomerate formations. The latter formation is overlying the Qulqula Radiolarian Formation (Buday, 1980). The age and stratigraphic position of this group is controversial because of insufficient studies and complex structure of the occurrence area (Karim, 2003). According to Buday (1980) the Qulqula Conglomerate Formation was firstly described by Bolton in 1955, but a more precise definition and description was given by the same author in (Buday 1958). No changes were introduced in the definition of the formation since that time and no fossils were reported till that time (1980) and the contacts of the formation are not precisely defined and known.

Twelve thin sections from the studied area (Pebbles from Qulqula Conglomerate) were investigated with regard to their content of larger foraminifera.

In this study twenty species of larger foraminifera were described and figured. The stratigraphic distribution and relative abundance of these species in the studied section are given in (Fig. 2).

PREVIOUS WORKS

Jassim *et al.*, (1984) mentioned that the Cenomanian unit is the equivalent of the Qulqula Conglomerate Formation and they cited that the unit is characterized by the following fossils: *Ovalviolina* sp., *Hemicyclina sigali*, *Hedbergella washitensis*, *Hedbergella* sp., *Thalmaninella ticinensis*, *T. appenninca*, *Praealveolina* sp., *Dicyclina* sp. Sissakian, (1997) has shown the formation on the geological map of the Arbeel and Mahabad Quadrangles area. Karim, (2003) cited that the Qulqula Formation (Qulqula Radiolarian Formation) deposited in a subduction trench forming an accretionary prism during the colliding of the Iranian and Arabian plates.

Al-Barzinjy, (2005) mentioned that the lithology of the Red Bed Series is mostly derived from Qulqula Group and Ophiolites. Sissakian, (2005) used Qulqula series instead of Qulqula Group and indicated the environment of the upper part of the series (Qulqula Conglomerate Formation) as marine Eugeosynclinal (flysch type), with age of Cenomanian-Santonian age.

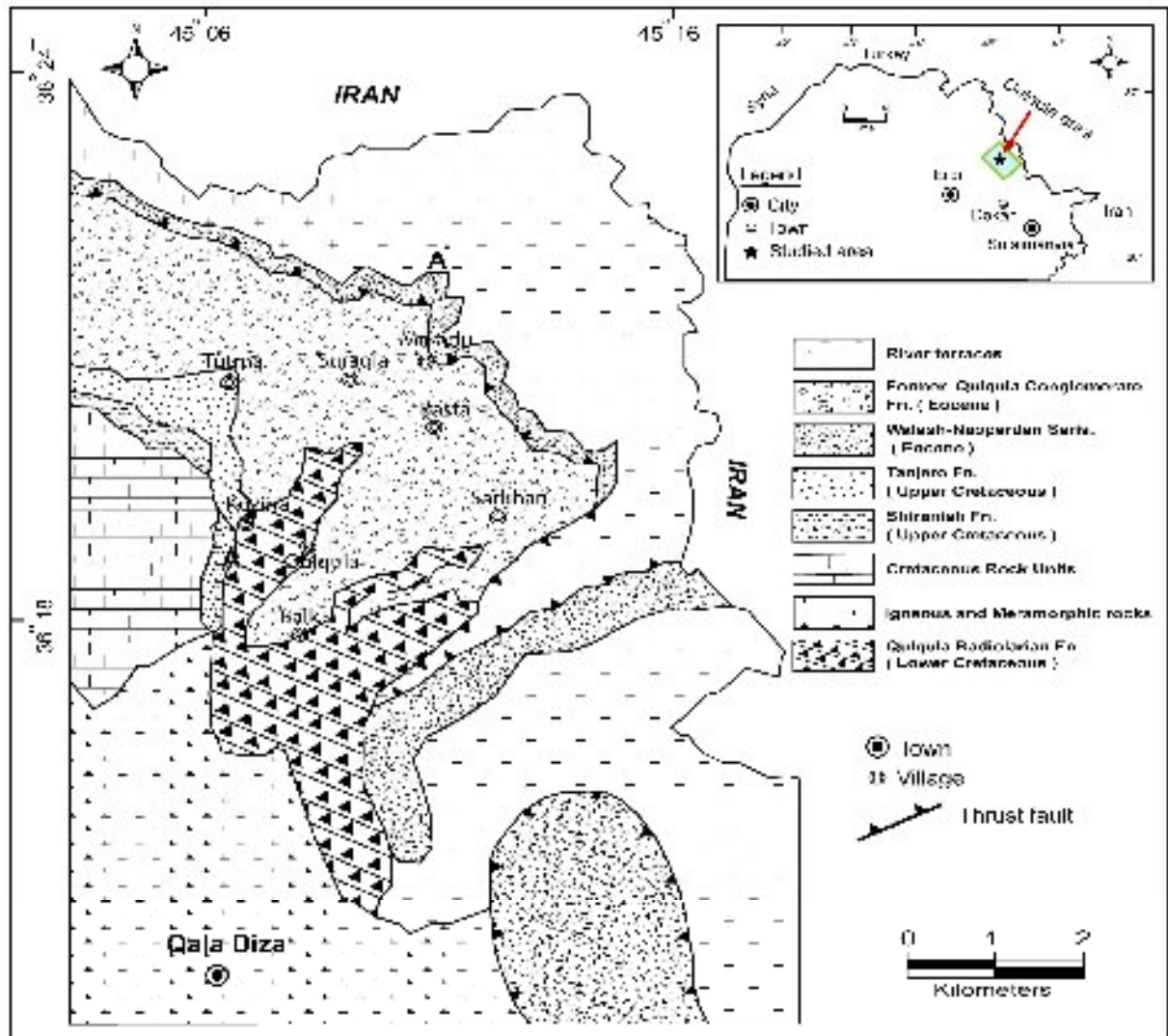


Fig. 1: Location and geological map of studied area (Baziany, 2006).

Baziany (2006) studied the former Qulqula Conglomerate Formation in Sulaimani Governorate in detail and mentioned for the first time numerous well-preserved larger foraminifera *Nummulites* and *Alveolina* in the milky pebbles of the conglomerates. He also recognized a clear angular unconformity between the former Qulqula Conglomerate Formation and the underlying Qulqula Radiolarian Formation. He changed the age of the formation from Cenomanian-Santonian to younger than Eocene.

Karim and Baziany, (2007) studied the Qulqula Conglomerate Formation and Red Bed Series at the type area (Qulqula Gorge), NE-Iraq, and they recognized large forams like *Alveolina* and *Nummulite* and determined the age of former Qulqula Conglomerate Formation from Paleocene- Eocene.

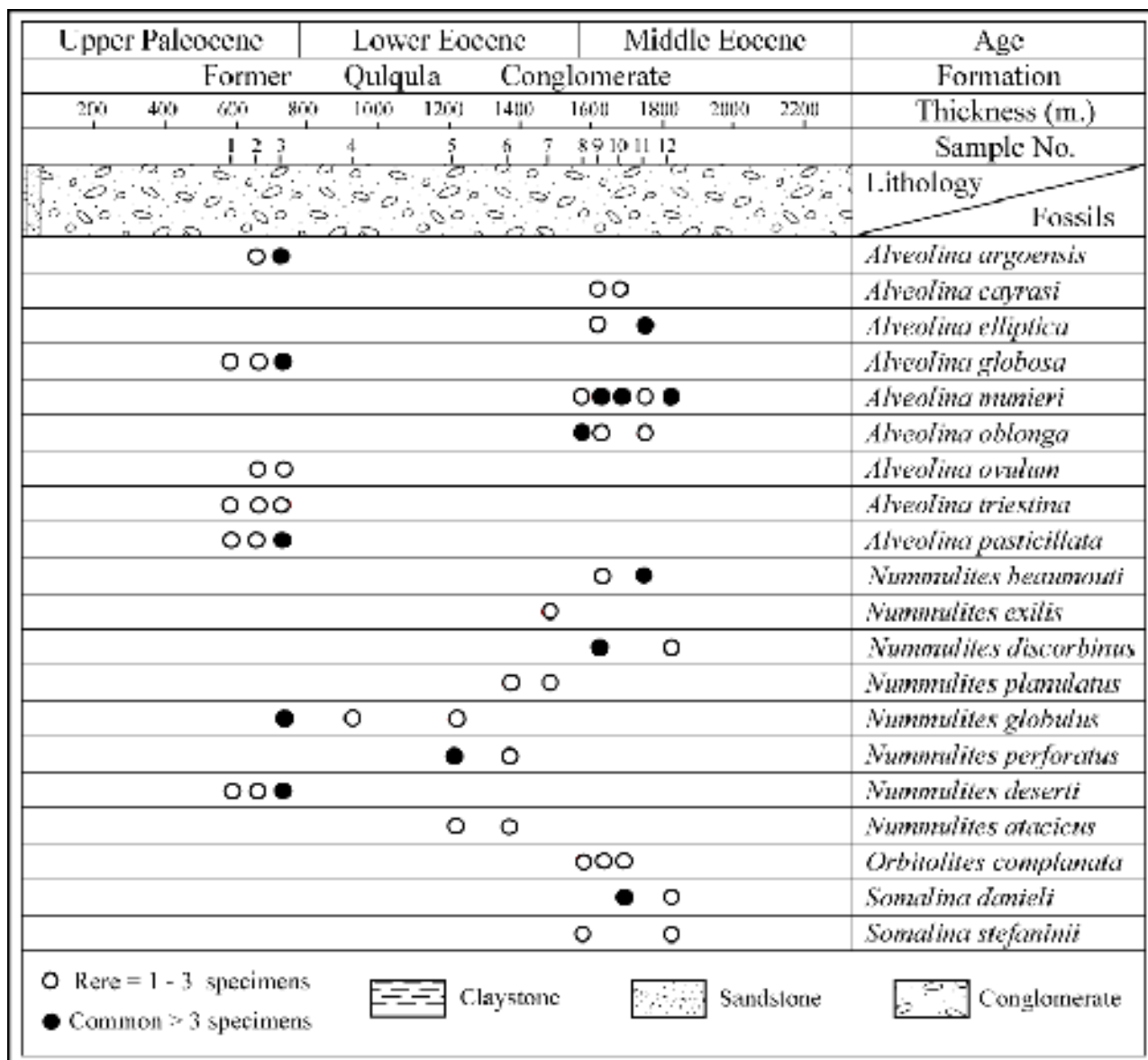


Fig. 2: Distribution of the larger foraminifera in the former Qulqula Conglomerate Formation in the studied area.

Baziany and Karim, (2007) studied the Qulqula Conglomerate Formation that is about 500m thick at Halabja-Avroman area. They proved that the large forams like *Alveolina* and *Nummulite* are not present in this area. They changed the age of Qulqula Conglomerate Formation, from Albian-Cenomanian, to Quaternary. This is aided by geomorphologic, stratigraphic, structural and sedimentologic evidence.

SYSTEMATIC DESCRIPTION**Order:** Foraminiferida Eichwald, 1830**Suborder:** Miliolina Delage & Herouard, 1896**Superfamily:** Alveolinacea Ehrenberg, 1839**Family:** Alveolinidae Ehrenberg, 1839**Genus:** *Alveolina* D'Orbigny, 1826**Type species:** *Alveolina oblonga* D'Orbigny, 1826*Alveolina argonensis* Hottinger

(Pl.1; 14)

1960 *Alveolina argonensis* Hottinger, p.109-111, figs. 60a-f.1969 *Alveolina argonensis* Hottinger, Sampo, pls ixiii, ixv.**Description:**

Test is elongated to elliptical, wall porcellaneous, imperforate, size large about (9mm) in length and (4.5mm) in diameter, length / diameter average ratio is 2:1, basal wall thin, whorl number up to 16 in numbers, tightly coiled, chamberlets are numerous 20-24 per mm in the last whorl, megalosphere is small.

Occurrences:

Al-Hashimi and Amer, (1985) reported this species from the Upper Paleocene Sinjar Formation, Northwestern Iraq, in the studied area this species recorded in the Upper Paleocene of the former Qulqula Conglomerate Formation. Sharbazeri, 1983 recorded this species from middle Eocene.

Alveolina cyarasi Dizer

(Pl.1; 4)

1965 *Alveolina cyarasi* Dizer, p.274, pl. 3, figs.1-3**Description:**

Test is cylindrical, with broadly rounded ends, wall porcellaneous, imperforate, size large about (8.5mm) in length and (3mm) in diameter, length / diameter average ratio is 2.6:1, basal wall thin, whorls up to 24 in numbers, tightly coiled, early whorls are relatively elongated, chamberlets numerous 21-25 per mm in the last whorl, higher than broader, supplementary chamberlets exist towards last whorls, megalosphere is small.

Remarks:

In this study *A. cyarasi* Dizer is reported from Middle Eocene. Abawi and Sharbazeri, (1987) reported *A. cyarasi* Dizer for the first time from Middle Eocene of Iraq and the Iraqi form differ from the type *A. cyarasi* by its smaller size and by its broadly rounded rather than the description of this species a maximum length up to (22.1mm) and a diameter up to (6.9mm).

Occurrence:

A. cyarasi is originally described from the Lower-Middle Eocene of Cayras in Northwest Turkey. Abawi and Sharbazeri, (1987) described this species from the Middle Eocene in the Middle part of the Geli Duhok section, northeastern Iraq.

This species is rare to common in the former Qulqula Conglomerate Formation.

Alveolina elliptica (Sowerby)

(Pl.1; 5, 12)

1840 *Fascoilites elliptica* Sowerby, Trans. Geol. Soc. London, Ser.2, Vol. 5, pp.329, pl. 18, figs. 17-17a.

1925 *Alveolina elliptica* (Sowerby), Nuttall, p.378, pl. 20, figs. 1.

1960 *Alveolina elliptica* (Sowerby), Hottinger, p.146, pl. 121, figs. 1-3.

1974 *Alveolina elliptica* (Sowerby), Al- Hashimi, p.54, pl. 1, figs. 2-3.

Description:

Test is cylindrical, with bluntly rounded ends, wall porcellaneous, imperforate, size relatively large attaining (4.9-6.6mm) in length and (2.5-3mm) in diameter, length / diameter 3average ratio is 2:1, whorl 9-15 in number, chamberlets in a single being higher than broader, numbering 13-16 per mm in the last whorl, megalosphere is small.

Occurrence:

Sowerby described this species originally from Cutch in India. Al-Hashimi, (1974) described it from the Middle Eocene Chabd beds of southwest Iraq. It has been also reported from Middle Eocene Naoprdan Shally Group of northeast Iraq. Sharbazheri, (1983) reported this species from the Middle Eocene in the Avanah Formation, northern Iraq. Al-Hashimi and Amer, (1985), Abawi and Sharbazheri, (1987) described it from the Middle Eocene in the middle part of the Geli Duhok section, northeastern Iraq. In the present study, *Alveolina elliptica* is common in the former Qulqula Conglomerate Formation of the Middle Eocene age.

Alveolina globosa Leymerie

(Pl.1; 2, 11, 13)

1846 *Alveolina globosa* Leymerie, p.337-373, pl. 13

Description:

Test is elliptical to cylindrical, wall porcellaneous, imperforate, size relatively large attaining (5-6.1mm) in length and (3-3.2mm) in diameter, length / diameter ratio is about 2:1, whorl 8-14 in numbers, chamberlets are numerous in the last whorl, megalosphere is small.

Occurrence:

Al-Hashimi and Amer, (1985), described *A. globosa* in Sinjar Formation, northern Iraq, of Upper Paleocene. In the present study, *A. globosa* is common in the Upper Paleocene of the former Qulqula Conglomerate Formation.

Alveolina munieri Hottinger

(Pl.1; 1, 8, 9)

1960 *Alveolina munieri* Hottinger, p.165, pl. 16, figs. 16-21, pl. 17, figs. 1-4, pl. 18, figs. 1-4, 18.

Description:

Test is elongate to cylindrical, with rounded to subrounded ends, wall porcellaneous, imperforate, size relatively large attaining (4.5-6mm) in length and (1.2-2.1mm) in diameter, length / diameter average ratio is 4:1, whorl 12-18 in numbers, tightly coiled, basal wall thin equatorially and thickness towards the poles, chamberlets are numerous and small, supplementary chamberlets exists in adult whorls, megalospheric is small and elongate.

Remarks:

The Iraqi forams generally have a smaller size and larger number of spires than the original specimen, other characters corresponds well.

Occurrence:

A. munieri is originally described by Hottinger, (1960) from the Middle Eocene of north Italy. Al-Hashimi and Amer, (1985), reported this species from the Middle Eocene in the Avanah Formation of Geli Dohuk, northern Iraq. Sharbazeri, 1983, Abawi and Sharbazeri, (1987) reported this species as a rare to common in the middle and upper part of Geli Bessri section and in the middle part of Geli Dohuk section (Middle Eocene), northern Iraq. Al-Banna and Al-Mutwali, (2008) recorded it in Walsh Group Northeastern Iraq. In the present study, *A. munieri* is distributed in the former Qulqula Conglomerate Formation as a common in the Middle Eocene.

Alveolina oblonga D'Orbigny

(Pl.1; 3, 6)

1826 *Alveolina oblonga* D'Orbigny, Tableau methodique, Ann, Sci, Nat. Paris, Ser. 1, Vol. 7, p.306.

1960 *Alveolina oblonga* D'Orbigny, Hottinger, p.141, pl. 9, figs. 4-16.

Description:

Test is subcylindrical to elliptical, with broadly rounded ends, wall porcellaneous, imperforate, medium size attaining (3-4mm) in length and (1.1-1.7mm) in diameter, length / diameter average ratio is 2.2:1, whorl 8-12 in number, chamberlets in single layer (17-22) per mm in the last whorl, megalosphere is oval, large and attains 171-222µm diameter.

Remarks:

The investigated specimens are closely related to *A. oblonga* D'orbigny

Occurrence:

A. oblonga is originally described from the Lower Eocene of the Paris basin; it is also reported from the Lower Eocene of France, Italy, Spain and Egypt. Al-Hashimi, (1975) reported this species from the Lower Eocene in Naoprda Group of northeast Iraq. Al-Omari and Sadek, (1975) reported *A. cf. oblonga* from the *Alveolina* bearing strata of Middle Eocene age in Dohuk area, northern Iraq. Sharbazeri, (1983) and Abawi and Sharbazeri, (1987) reported this species from Middle Eocene in the Avanah Formation, northern Iraq. In the present studies, *A. oblonga* is rare in the Middle Eocene of the studied section.

Alveolina ovulum Stache in Schwager

(Pl.1; 7)

1883 *Alveolina cf. ovulum* Stachein Schwager, p.95, pl. 24, fig. 13-a-c.

Description:

Test is ovate to elongate cylindrical, with rounded to subrounded ends, wall porcellaneous, imperforate, size relatively large attaining (3.5-4mm) in length and (1.2-1.8mm) in diameter, length / diameter average ratio is 2.2:1, whorl 7-12 in numbers, chamberlets numerous and in a single layer (6-11) per mm in the last whorl, megalosphere is oval.

Occurrence:

A. ovulum is reported in the studied area from Upper Paleocene.

Alveolina triestina Hottinger

(Pl.1; 10)

1960 *Alveolina triestina* Hottinger, p.1-244, pl. 18, fig. 1-117.1+a-b-c.

Description:

Test is cylindrical, with subrounded ends, wall porcellaneous, imperforate, size relatively large attaining (3-4mm) in length and (1.2-2mm) in diameter, length / diameter average ratio is 1:2, whorl 7-11 in numbers, chamberlets numerous and in a single layer (5-10) per mm in the last whorl, megalosphere is oval.

Occurrence:

A. triestina in the studied area is recorded from Upper Paleocene in the former Qulqula Conglomerate Formation.

Alveolina pasticillata Schwager

(Pl.1; 15)

1883 *Alveolina pasticillata* Schwager, p.79-154, pl. 24-29(1-6).

Description:

Test is cylindrical, with rounded ends, wall porcellaneous, imperforate, size relatively large attaining (3-4mm) in length and (1.1-1.7mm) in diameter, length / diameter average ratio is 2.2:1, whorl 6-11 in number, chamberlets numerous, megalosphere is rounded.

Occurrence:

A. pasticillata is reported in the studied area of Upper Paleocene in the former Qulqula Conglomerate Formation.

Suborder: Rotaliina

Superfamily: Nummulitacea de Blainville, 1827

Family: Nummulitidae de Blainville, 1825

Subfamily: Nummulitinae Carpenter, 1850

Genus: *Nummulites* Lamarck, 1801

Type species: *Nummulites laevigatus* (Bruguiere) *Camerina laevigata* Bruguiere, 1792

Nummulites beaumonti D'Archiac and Haime

(Pl.2; 4)

1853 *Nummulites beaumonti* D'Archiac and Haime, p.133, pl.5, figs. 1a-c, 2-3

1926 *Nummulites beaumonti* D'Archiac and Haime Nuttal, p.130, pl.1, figs. 4-5

- 1940 *Nummulites beaumonti* D'Archiac and Haime Davies, p.206, pl.9, figs. 1-9
 1959 *Nummulites beaumonti* D'Archiac and Haime Nagappa, p.180, pl.8,
 figs.15-17; pl.9, figs. 1-2
 1962 *Nummulites beaumonti* D'Archiac and Haime Schaub, p.135-196, pl.53,
 figs.17-19, 22-25, tab.14p
 1965 *Nummulites beaumonti* D'Archiac and Haime Sen Gupta, p.91-93, pl.15,
 figs. 1-2, 5; pl.16, figs. 3- 7, 9-10; pl.17, figs. 1,5-7, 12
 1972 *Nummulites beaumonti* D'Archiac and Haime Blondeau, p.149, pl.24,
 figs.11-14

Description:

Test is small, thickly lenticular to biconvex, regularly sloping and sometimes depressive in the ambo. The spherical to subspherical protoconch is followed by a reniform deutroconch of second chamber, and both chambers are followed by closely coiled whorl. The septa are straight or slightly curved. The spiral wall is thick. The diameter varies from (2.3-3.3mm) and thickness varies from (1.6-2.2mm), the diameter / thickness ratio from 1:1.4-1:2.0.

Remarks:

This species has small protoconch, a tight coiling of spiral wall, rhombic style of chamber form, and radial septa, which shown in the Numal beat from Egypt, Libya and the type area of the Lower Tertiary rocks of the Pakistan-India region (D'Archiac and Haime, 1853; Nuttall, 1926; Davies, 1940; Nagappa, 1959; Sen Gupta, 1965; Matsumaru and Saki, 1989).

Occurrence:

(Al-Hashimi and Amer, 1985) recorded this species from the Middle Eocene in Iraq, In the studied area it was recorded in Middle Eocene.

Nummulites exilis Douville

(Pl.2; 5)

- 1919 *Nummulites exilis* Douville, H., p.1-84, pl. 1, figs. 42; pl. 63, tfs. 10-11; pl. 64, tfs.12.
 1951 *Nummulites exilis* Douville, Vialli, V., Vol.90, no. 2-3, p.97-168, pl. 5, figs.20-29
 1959 *Nummulites exilis* Douville, Biede, F., p.31-37, (English), pl. 1, figs.5.

Description:

Test is small, lenticular, biconvex, subspherical protoconch, equatorial periphery circulars, axial periphery acute, the diameter varies from (1.2-2.2mm) and thickness varies from (0.8-1.7mm), the diameter / thickness ratio from 1.2:1.6.

Remarks:

N. exilis distinguish from *N. discorbinus* in having smaller and globular test, shape less biconvex, thin lamina.

Occurrence:

This species recorded from the Lower Eocene in France, (Douville, 1919), Spain (Ruiz, 1948), Poland (Biede, 1959). Al-Hashimi and Amer, (1985) recorded this species from the Lower Eocene in Iraq. Al-Banna and Al-Mutwali, (2008) recorded it in Walash Group Northeastern Iraq. In the studied area this species recorded in Middle Eocene in the former Qulqula Conglomerate Formation.

Nummulites discorbinus Schlotheim
(Pl.2; 3)

- 1883 *Nummulites discorbinus* Schlotheim, Harpe, p.de.la, p.1-373, pl. 9, figs.2b-2t, 3.
 1902 *Nummulites discorbinus* Schlotheim, Martelli, A., Vol.8, p.43-97, pl. 6, (1), figs.4
 1928 *Nummulites discorbinus* Schlotheim, Checchia-Rispoli,G., Vol.53, no.6, p.1-6, pl. 1, figs.9-10.
 1954 *Nummulites discorbinus* Schlotheim, Smont, A. H., p.1-96, pl. 13, (1),figs.4,6-7.

Description:

Test is small, lenticular to biconvex, spherical to subspherical protoconch, equatorial periphery circulars, axial periphery subacute to acute, the diameter varies from (1-1.9mm) and thickness varies from (0.5-1.5mm), the diameter / thickness ratio 1.3:1.7:1.

Remarks:

N. discorbines distinguished from *N. exilis* in having larger and more subglobular test, shape more biconvex, thick lamina, rods shaped chambers.

Occurrence:

This species recorded from the Middle Eocene in Egypt (Harpe, 1883), Italy (Rege, R., 1928), Qatar (Smout, 1954). Al-Hashimi and Amer, (1985) recorded this species in the Middle Eocene in Iraq. In the studied area this species also recorded in Middle Eocene in the former Qulqula Conglomerate Formation.

Nummulites planulatus Lamarck
(Pl.2; 8)

- 1853 *Nummulites planulatus* Lamarck, D'Archiac, A. and Haime, p.1-373, pl. 9, figs. 5, 6, 6c, 7b-e.
 1926 *Nummulites planulatus* Lamarck, Nuttall, W.L.F., Vol.63, p.112-120, pl. 10, figs.1-12.
 1942 *Nummulites planulatus* Lamarck, Silvestri,A., Vol.32, Suppl.5, p.1-94, pl. 28, figs. 5.
 1960 *Nummulites planulatus* Lamarck, Cole,W.S., Vol.41, no.190, p.189-205, pl.23, figs.1,3-4,6; pl. 26, figs.3.

Description:

Test is medium to large, lenticulars to subglobulars, well preserved specimens, the diameter varies from (1.2-2.9mm) and thickness varies from (0.9-1.8mm), the diameter / thickness ratio from 1.3:1:8.

Remarks:

N. planulatus varies from *N. pertrrnats* by having large test, large protoconch, more thickened, and more acute chambers.

Occurrence:

N. planulatus recorded from the Lower Eocene in France (Boussac, 1911), Switzerland (Cole, 1960), Spain (Ruiz de Gona, 1948). Al-Hashimi and Amer, (1985) recorded this species from Lower Eocene in Iraq. Al-Mutwali and Abawi, (2001)

recorded this species from Ratga Formation (Western Iraq) of upper Early Eocene age. In the studied area this species also recorded in Lower Eocene in the former Qulqula Conglomerate Formation.

Nummulites globulus Leymerie

(Pl.2; 2)

- 1846 *Nummulites globulus* Leymerie, p.359, pl. 13, figs. 14a-d.
 1919 *Nummulites globulus* Leymerie, Douville, p.54, pl. 1, figs.11-17.
 1926 *Nummulites planulatus* d'Archaic,Doncieux, p.37, pl. 5, figs. 1-7.
 1952 *Nummulites globulus* Leymerie, Azzaroli, p.120, pl. 9, figs. 4, 5.
 1959 *Nummulites globulus* Leymerie, Papp, p.167, text figs. 3c, 4, 5a, b.
 1967 *Nummulites globulus* Leymerie, Nemkov, p.202, pl. 26, figs.1-8.

Description:

Megalospheric form, external features, Test is small to medium sized, lenticular to subglobulars, equatorial periphery circulars, axial periphery subacute to acute, well preserved specimens, the diameter varies from (1-2.8mm) and thickness varies from (0.6-1.5mm), the diameter / thickness ratio from 1.4:1.7:1.

Remarks:

N. globulus is distinguished from other *Nummulites* species in having a larger and subglobulars test, a rather smooth surface, thick lateral laminae, needle shaped chamber cavities. Well marked alar prolongations, distinct and well developed polar plugs.

Occurrence:

Leymerie described *N. globulus* from the Tertiary of France. It was also described from Lower Eocene of the Pyrenees, France by Douville (1919); from the Middle Eocene of Spain by Gomez lueca (1929); from the Lower to Middle Eocene of Albania by Cizancourt (1931); from the Lower to Middle Eocene of Algeria by Flandrin (1938); from the Paleocene to Lower Eocene of Switzerland by Schaub (1951); from the Lower Eocene of Somaliland by Azzaroli (1952); from the Lower Eocene of Qatar by Smout (1954); from the Lower Eocene of Austria by Papp (1959); from the Lower to Middle Eocene in the Rakhi Nala section of Pakistan by Bayliss (1961) and from the Lower Eocene of the Egypt. (Hamam, 1975), Al-Hashimi (1973) recorded this species from Upper Paleocene to Lower Eocene in northeast Iraq. Al-Mutwali and Abawi, (2001) recorded this species from Ratga Formation (Western Iraq) of upper Early Eocene age. In the studied area this species recorded from Upper Paleocene to Lower Eocene age in the former Qulqula Conglomerate Formation.

Nummulites perforatus Montfort

(Pl.2; 7)

- 1883 *Nummulites perforatus* Montfort, pl. 3, figs.1-3
 1911 *Nummulites bayhariensis* Checchia-Rispoli, p.131, pl. 4, figs. 9-11.
 1948 *Nummulites perforatus* Montfort, Van Andel, p.1013 text figs.

Description:

Test is lenticular, biconvex, equatorial periphery circulars, axial periphery acute to subacute, well preserved specimens, the diameter varies from (1.1-2.7mm) and thickness varies from (0.8-1.7mm), the diameter / thickness ratio from 1.2:1.5:1.

Remarks:

N. perforatus is distinguished from *N. exilis* in having smaller and subglobular test, with large proloculus.

Distribution:

N. perforatus recorded from Lower Eocene in Switzerland (Harpe, 1883); Spain (Gomez, Liueca 1929); Austria (Papp, 1959). Al-Hashimi and Amer, (1985) recorded this species from Lower Eocene in northeast Iraq. In the studied area this species recorded from Lower Eocene age in the former Qulqula Conglomerate Formation.

Nummulites deserti De La Harpe
(Pl.2; 1)

- 1883 *Nummulites deserti* De La Harpe, Vol. 30 (Ser.3, Vol.6), Pal. Sect.1, p.155-218, pl. 31(2), figs. 239.
 1953 *Nummulites deserti* De La Harpe, LeRoy, L.W, no. 54, p. 1-73, pl.11, figs 17-19.
 1961 *Nummulites deserti* De La Harpe, Said, R., and Kerdany, Vol. 7, no. 3, p. 317-336, pl. 326, text figs.7(1a-c).

Description:

Test is biconvex, lenticular, spherical to subspherical protoconch, axial periphery subacute to acute, radius varies from (1.2-1.8mm) and thickness varies from (0.4-1.6mm), the diameter / thickness ratio from 1.2:1.6.

Occurrence:

N. deserti is recorded from Eocene in Egypt (Harpe, 1883); Lower Eocene in Egypt (Said and Kerdany, 1961). Al-Hashimi and Amer, (1985) recorded this species from Upper Paleocene in Iraq. In the studied area this species recorded from Upper Paleocene age in the former Qulqula Conglomerate Formation.

Nummulites atacicus Leymerie
(Pl.2; 6)

- 1846 *Nummulites atacicus* Leymerie, A., Vol.1 Pt.2, p.337-373, pl. 13, figs. 13b, 13e.
 1926 *Nummulites atacicus* Leymerie, Doncieux, L., Lyon, p. 1-99, pl. 4, figs.1-3.
 1939 *Nummulites atacicus* Leymerie, Silvestri, A., Vol.32, Suppl.4,p.1-102, pl.6, figs.1.
 1960 *Nummulites atacicus* Leymerie, Nemkov, G.I. and Barkhatova, No. 5, p.29-43, pl. 2, figs. 7.

Description:

Test is lenticular to biconvex, small to medium sized, lenticular to subglobular, equatorial periphery circulars, axial periphery subacute to acute, well preserved specimens, the diameter varies from (1-2.6mm) and thickness varies from (0.7-1.6mm), the diameter / thickness ratio from 1.3:1.6:1.

Remarks:

N. atacicus is distinguished from *N. discorbinus* in having a larger and subglobular test, with large proloculus.

Distribution:

N. atacicus recorded from Lower Eocene in India (Nuttall, 1925); Switzerland (Schaub, 1951) and Middle Eocene in Italy (Azzaroli 1952). Al-Hashimi and Amer, (1985) recorded this species from Lower Eocene in northeast Iraq. Al-Mutwali and Abawi, (2001) recorded this species from Ratga Formation (Western Iraq) of Upper Early Eocene age. In the studied area this species recorded from Lower Eocene age in the former Qulqula Conglomerate Formation.

Family: Soritidae Ehrenberg, 1834

Subfamily: Soritinae Ehrenberg, 1839

Genus: *Orbitolites* Lamarck, 1801

Type species: *Orbitolites complanata* SD Douville, 1902

Orbitolites complanata Lamarck

1801 *Orbitolites complanata* Lamarck, Systeme des animaux sans vertebres, p. 376.

1925 *Orbitolites complanata* Lamarck; Nuttall, p. 447.

1939 *Orbitolites complanata* Lamarck; Silvestri, p. 44, pl. 6, figs. 4-5, pl. 8, fig.1.

Description:

Test is porcelaneous, discoidal in shape and have numerous chambers which are arranged in successive, annular series; chambers are subdivided into chamberlets separated by thick walls and alternate in position with those of the previous cycle; test is thicker near the periphery than at the centre and is relatively large attaining (5-8mm) diameter and (0.5 - 1mm) thickness.

Occurrence:

This species is originally described from the Eocene of France. The species is worldwide and it is reported from Eocene age of many parts of the world. It has been also reported from Eocene age of Southwest and Northeast of Iraq (Al-Hashimi and Amer, 1985). Al-Omari and Sadek (1975) reported *O. cf. complanatus* Lamarck from the Middle Eocene Alveolina-bearing strata of Dohuk area. Abawi and Sharbazeri, (1987) reported *O. complanata* in the Middle Eocene from the Avana Formation, Northern Iraq. In the studied area *O. complanata* is rare to common in the Eocene age.

Genus: *Somalina* A. Silverstri, 1939

Type species: *Somalina stifaninii* Silverstri, 1939

Somalina danieli Henson

(Pl.2; 9)

1950 *Somalina danieli* Henson, p. 60, figs. 2-3.

Description:

Test is porcelaneous, discoidal to compress lenticular in shape; it is made up of equatorial chamber layer of annular chambers with lateral chamber layers on either side. Equatorial layer is thicker near the periphery than at the center with the chambers arranged alternately; lateral chambers are with minute vacuoles distributed irregularly between successive layers; diameter of the test is (10-14mm), thickness is (1.1mm) the

central part and 0.5 mm near the margin; thickness of the equatorial layer near the margin is 0.32 mm.

Remarks:

S. danieli Henson is distinguished from the closely resembling *S. stefaninii* Silvestri (1939) by its discoidal rather than lenticular shape and by its smooth surface.

Occurrence:

Henson, 1950 described *S. danieli* originally from the Middle Eocene of Southwest Iraq. Buday (1980, p. 225) reported this species from the Middle Eocene Dammam Formation in Iraq. Sharbazeri, 1983 and (Abawi and Sharbazeri, 1987) reported *S. danieli* from the Middle Eocene in the Avanah Formation, Dohuk area, Northern Iraq. In the studied area *S. danieli* is recorded from the Middle Eocene age.

Somalina stifaninii Silversti

(Pl.2; 11)

1939 *Somalina stifaninii* n. sp. Silversti, p. 52, figs. 2-3.

1964 *Somalina stifaninii* Silversti Sampo, pls., ixix, lxxv.

Description:

Test is porcelaneous, lenticular in shape. Equatorial layer is thicker near the periphery than at the center with the chambers arranged alternately, diameter of the test is (9-13mm), and thickness is (1-1.1mm) in the central part and 0.4 mm near the margin.

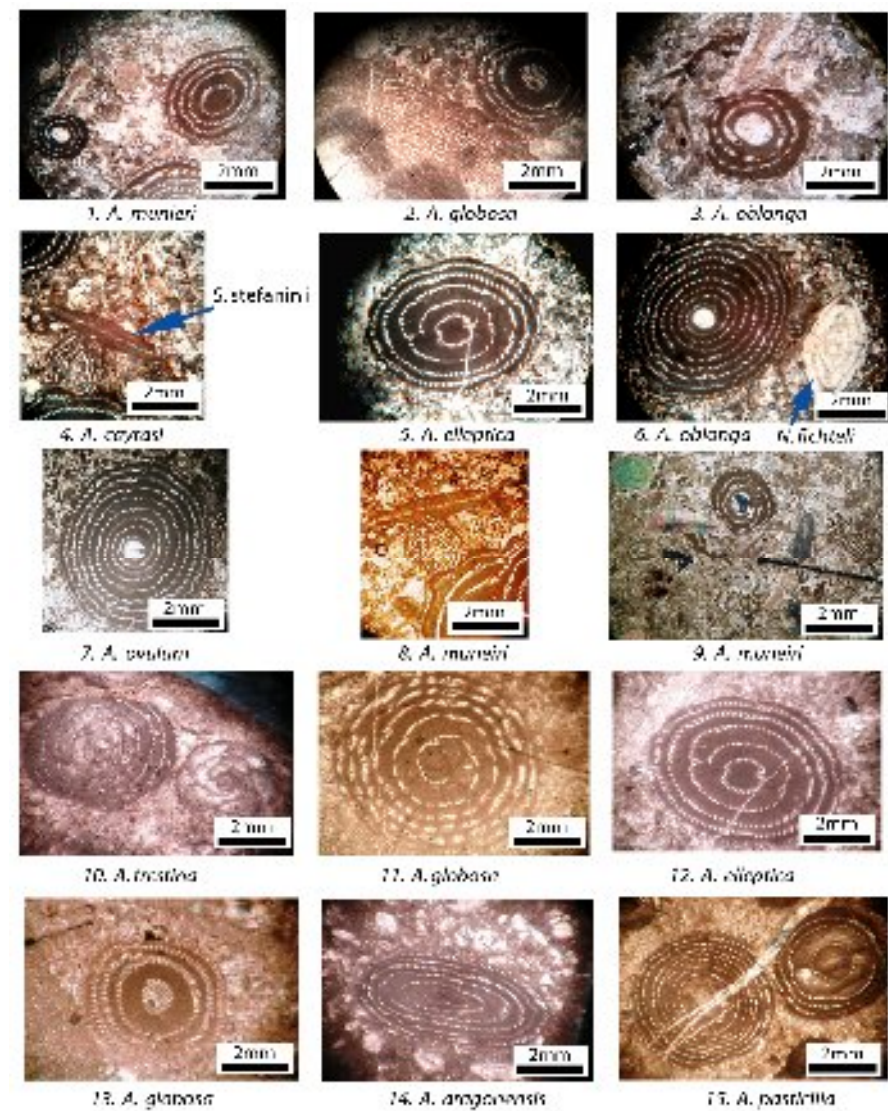
Remarks:

S. stifaninii Silversti is distinguished from the closely resembling *S. danieli* Henson by its lenticular rather than discoidal shape and by its coarse surface.

Occurrence:

Sharbazheri, 1983 reported this species in the Lower-Middle Eocene in the Avanah Formation, Dohuk area, Northern Iraq. In the studied area *S. stifaninii* is reported from the Middle Eocene age.

Plate -1-

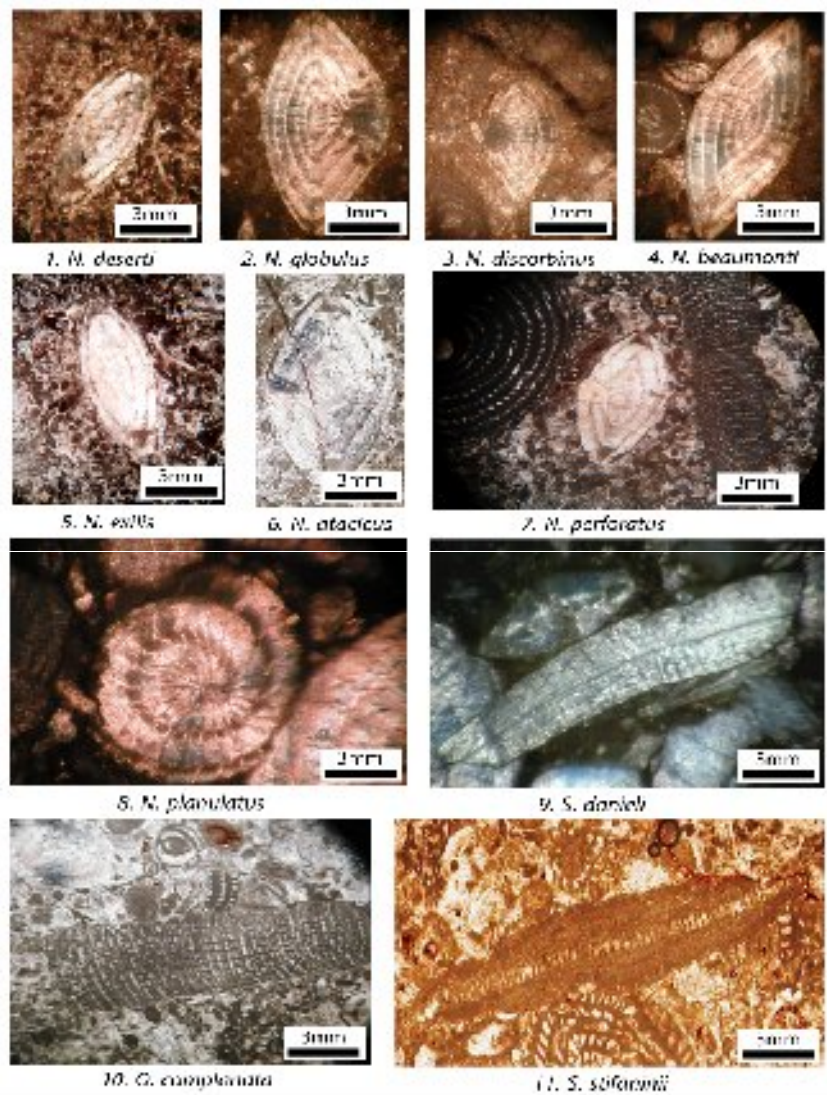


Pl.1: Larger foraminifera of the Alveolinidae in the pebbles of former Qulqula Conglomerate Formation in Qulqula gorge:

- 1, 8 and 9. *Alveolina munierei* Hottinger (M.-Eocene)
 1. Axial section, sample No. 9.
 8. Equatorial section, sample No.10.
 9. Equatorial section, sample No.12.
- 2, 11, 13. *Alveolina globosa* Leumerie (U.-Paleocene)
 2. Equatorial section, sample No. 1.
 11. Equatorial section, sample No. 2.
 13. Equatorial section, sample No. 3.
- 3, 6. *Alveolina oblonga* D'Orbigny (M.-Eocene)
 3. Equatorial section, sample No. 11.
 6. Axial section, sample No. 8.
4. *Alveolina cayrasi* Dizer (M.-Eocene), Equatorial section, sample No.9, x 60.
- 5, 12. *Alveolina elliptica* Sowerby (M.-Eocene)
 5. Axial section, sample No. 11.
 12. Axial section, sample No.8.

7. *Alveolina ovulum* (U.-Paleocene), Equatorial section, sample No. 2.
 10. *Alveolina triestina* Hottinger (U.-Paleocene), Equatorial section, sample No.2.
 14. *Alveolina argoensis* Hottinger (U.-Paleocene), Axial section, sample No. 3.
 15. *Alveolina pasticillata* Schwager (U.-Paleocene), Axial section, sample No.1.

Plate -2-



Pl.2: Larger foraminifera of the Nummulitidae and Soritidae in the pebbles of former Qulqula Conglomerate Formation in Qulqula gorge:

1. *Nummulites deserti* De La Harpe (U.-Paleocene), Axial section, sample No.3.
 2. *Nummulites globulus* Leymerie (U.-Paleocene-L.-Eocene), Axial section, sample No.3-4.
 3. *Nummulites discorbinus* Schlothemim (M.-Eocene), Axial section, sample No. 9.
 4. *Nummulites beaumonti* D'Archaic and Haime (M.-Eocene), Axial section, sample No.11.
 5. *Nummulites exilis* Douville (L.-Eocene), Axial section, sample No. 7.
 6. *Nummulites atacicus* Leymerie (L.-Eocene), Axial section, sample No. 6.
 7. *Nummulites perforatus* Montfortat (L.-Eocene), Axial section, sample No. 5.
 8. *Nummulites planulatus* Lamarck (L.-Eocene), Equatorial section, sample No.6.
 9. *Somalina danieli* Henson (M.-Eocene), Axial section, sample No.10.

10. *Orbitolites complanata* Lamarck (Eocene), Axial section, sample No. 8.
11. *Somalina stefaninii* Silverstri (M.-Eocene), Axial section, sample No. 9.

CONCLUSIONS

The study has the following conclusions

1. The pebbles of the former Qulqula Conglomerate Formation (present Red Bed Series) contain larger foraminifera of the Alveolinidae, Nummulitidae and Soritidae families in the type section of the formation.
2. The age of the recorded fossils assemblages range from Upper Paleocene to Middle Eocene age as following:
 - a. *Alveolina* assemblages indicator of Upper Paleocene to Middle Eocene.
 - b. *Nummulite* assemblages. indicator of Lower to Middle Eocene.
 - c. *Orbitolites* assemblages. indicator of Middle Eocene.
 - d. *Somalina* assemblages indicator of Lower to Middle Eocene.
3. These assemblages are more likely belong to Walash–Naoprdan source area that deposited during Upper Paleocene to Middle Eocene. While the former Qulqula Conglomerate Formation is deposited during younger age which most possibly coincide with Late Paleocene.
4. The present study aids the rejection of the formation and it combines with Red Bed Series.

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